Fiscal Year 1996-1998
Investigations on New River

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ABSTRACT

Monitoring of salmonids in the New River Basin continued in fiscal years 1996 to 1998. New River summer steelhead surveys have occurred in either September or October since 1989. During the past ten years, adult summer steelhead counts have ranged from 251 to 765 fish, averaging 480 fish. Over the same period, half-pounders represented between 1.4 and 24.0 percent of all summer steelhead counted. For 1996-1998, counts of summer steelhead were 307, 651, and 495 fish respectively, with half-pounder percentages of 18, 7, and 1.4 respectively.

New River spring chinook counts for 1996-1998, were 45, 40, and 20 fish respectively. Annual spring chinook counts on New River over the last ten years (1989 to 1998) have ranged from 2 to 45 fish, averaging 22 fish. In comparison, spring chinook counts on the Salmon River (Klamath River tributary) over the same period have ranged from 148 to 1,249, averaging 731. South Fork Trinity River counts for the eight years (1991-1998) ranged from 66 to 1,097 fish, averaging 408 fish

New River chinook redd surveys resulted in the observation of 104, 181, and 11 redds in 1996, 1997, and 1998 respectively. Prior to 1996, annual chinook redd counts had ranged from a low of 6 to a high of 53.

Juvenile emigration catch totals for 1996 were 4,372 steelhead, 82 chinook, and 11 coho (this represented the first capture of coho since the onset of the study in 1989). Juvenile emigration catch totals for 1997 were 7,270 steelhead, 325 chinook, and 9 coho. Juvenile emigration catch totals for 1998 were 2,937 steelhead, 333 chinook. No coho were captured in 1998.

Juvenile emigration monitoring abundance indices for 1996 were 30,762 steelhead, 553 chinook, and 65 coho. Juvenile emigration abundance indices for 1997 were 50,840 steelhead, 1,974 chinook, and 118 coho. Juvenile emigration abundance indices for 1998 were 22,366 steelhead and 1,520 chinook. The 1997 steelhead abundance index total for the New River rotary trapping was the highest for the ten years of monitoring. The highest abundance index totals prior to 1997 had occurred in 1990 (33,884), 1991 (31,845), 1996 (30,762), and 1992 (30,299) respectively.

A comparison of juvenile salmonid index reach counts from 1990 through 1998, showed higher age 0 steelhead densities in the upper mainstem and tributary reaches than occurred in lower New River mainstem index reaches, and is likely associated with the proximity to spawning areas. This trend did not occur for age 1 and age 2 steelhead, whose densities, although lower than age 0 fish, did not differ appreciably between the lower and upper mainstem and tributary index reaches.

INTRODUCTION

New River is an undammed fifth-order tributary to the Trinity River in northwestern California (Figure 1). Fishes of the New River include summer, fall, and winter-run steelhead (*Oncorhynchus mykiss*); rainbow trout (nonandromous *O. mykiss*); speckled dace (*Rhinichthys osculus*); Klamath smallscale sucker (*Catostomus rimiculus*); Pacific lamprey (*Lampetra tridentatus*); fall chinook (*O. tshawytscha*) and a remnant run of spring chinook (*O. tshawytscha*). Very few coho salmon (*O. kisutch*) have been found in New River. These coho were represented by a few carcasses found during past weir operations and juveniles captured in a rotary trap. Presently, coho do not appear to utilize New River on a regular basis. Whether this is true historically or simply due to the decline of coho throughout their range is not known.

New River and its tributaries have an estimated 80 kilometers (km) of holding, spawning and rearing habitat of special importance to summer, fall, and winter-run steelhead. Estimates by California Department of Fish and Game (CDFG) indicate the number of wild summer steelhead in California range from 1,500 to 4,000 fish (Gerstung, personal communication, 1996). New River summer steelhead counts over the past decade have ranged from 307 to 804 fish, marking it one of the larger populations in California. Early fishery investigations in New River were conducted by the U.S. Forest Service (USFS) Big Bar Ranger District. The USFS characterized habitat suitability and accessibility in New River and its major tributaries with regard to summer and winter-run steelhead (Freese and Taylor 1979).

In 1984, portions of New River were included within the Trinity Alps Wilderness Area (Figure 2). In 1988, funded through the Trinity River Fish and Wildlife Restoration Act (TRFWRA) (P.L. 98-541), the U.S. Fish and Wildlife Service (FWS) began investigations in New River to identified habitat quantity and quality pertaining to spring chinook. In 1989, the scope of the project was increased to include fall chinook and all three races of steelhead. A monitoring program was established and has included annual adult counts (salmon and steelhead), redd surveys (salmon only), juvenile emigration monitoring, and juvenile over summer rearing densities.

The TRFWRA reauthorized funds in 1996 (P.L. 104-143) for an additional three years of monitoring during which time the project became a cooperative effort with the Hoopa Valley Tribe (HVT). This report presents results of monitoring conducted on New River for Fiscal Year (FY) 1996, 1997 and 1998, and attempts to integrate the results of the preceding years (USFWS 1991, 1992, 1994, 1995, 1996).

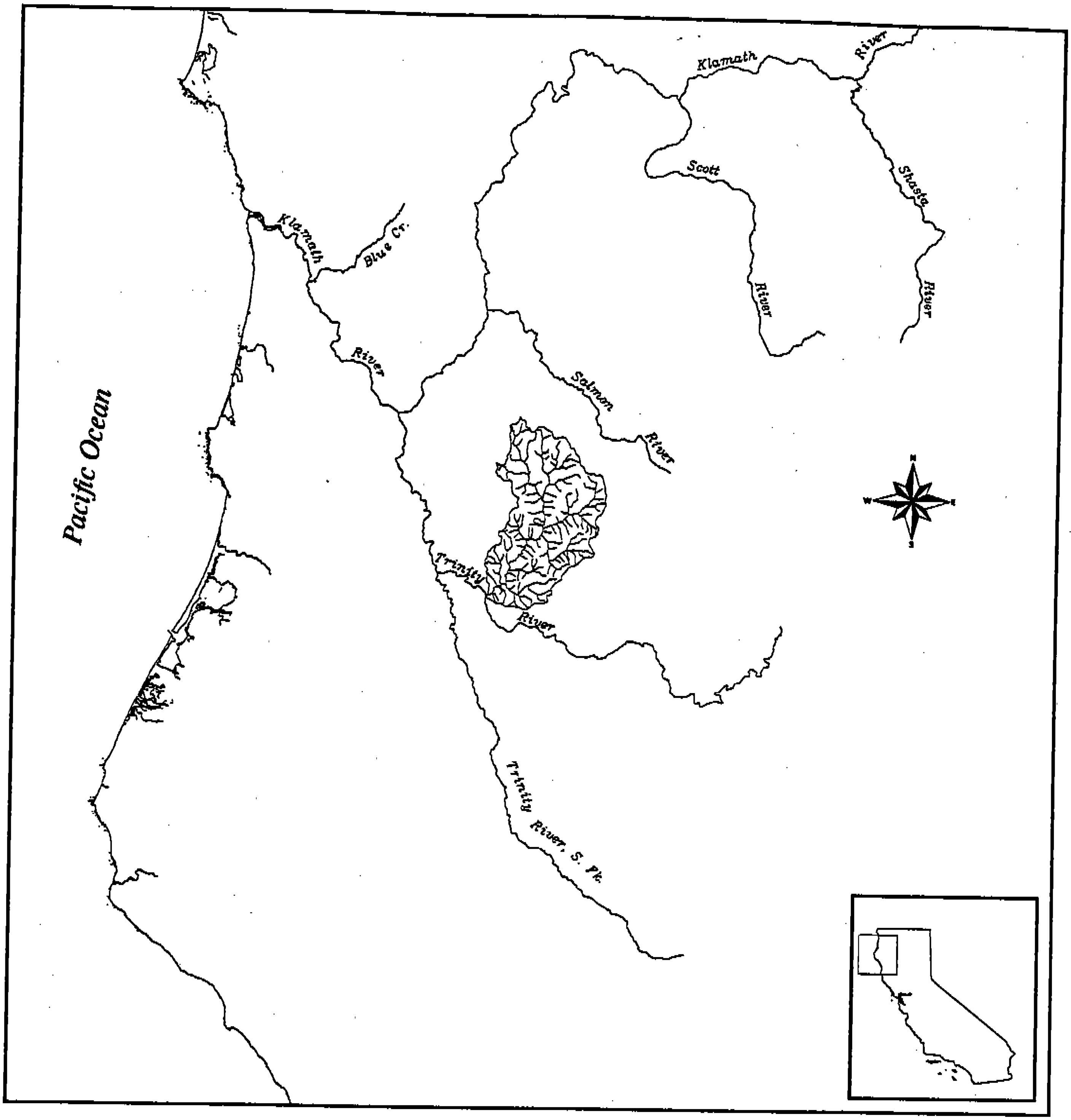

Figure 1. Location of New River watershed, Trinity River Basin, California.

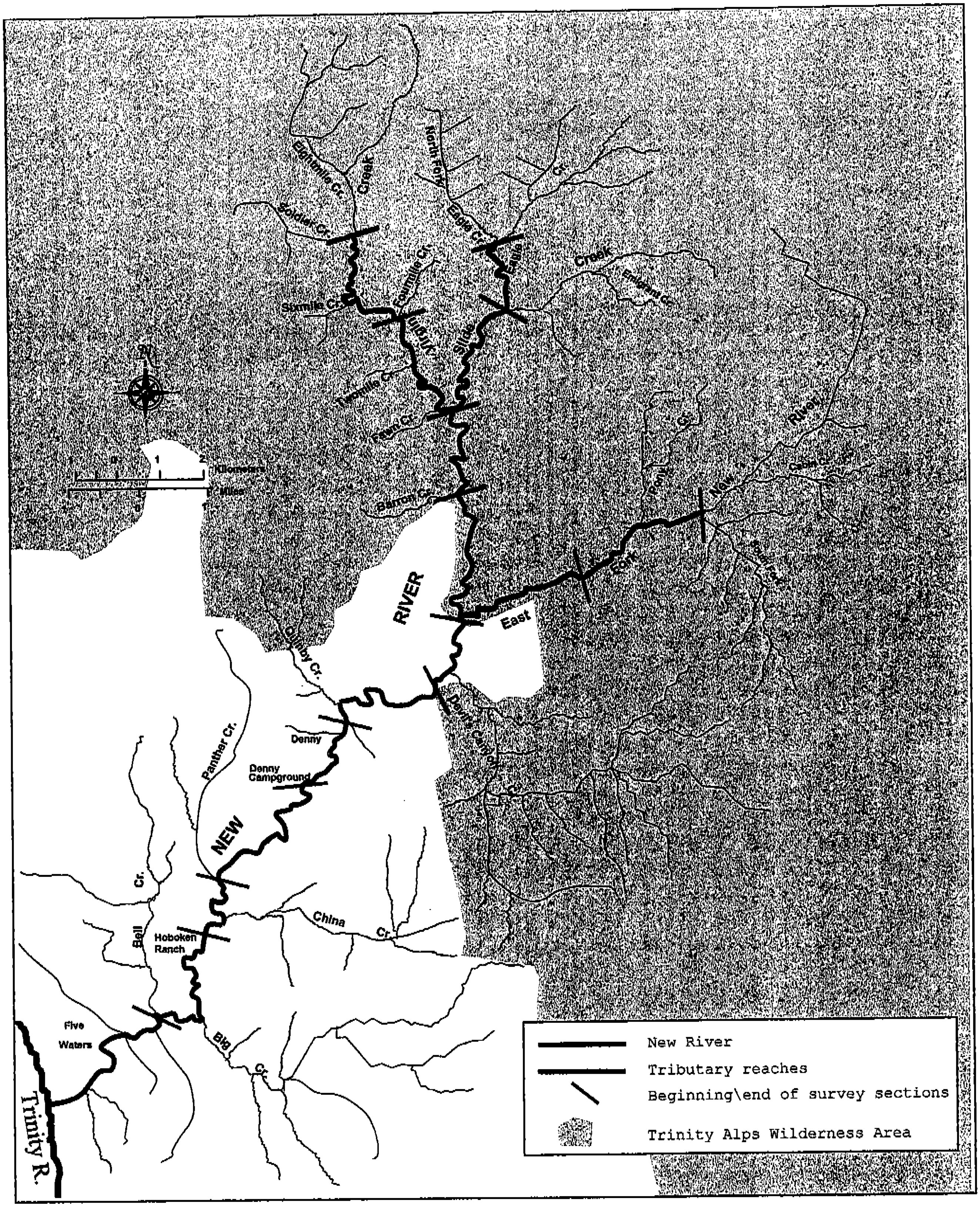

Figure 2. New River survey reaches and Trinity Alps Wilderness Area boundary.

MATERIALS AND METHODS

Adult Counts and Chinook Redd Surveys

Annual summer steelhead and spring chinook counts were conducted on New River (mouth to river kilometer (rkm) 33.8) and portions of the following tributaries: Virgin Creek (Soldier Creek to New River), Slide Creek (North Fork Eagle Creek to New River), and the East Fork (South Fork confluence to New River) (Figure 2). Counts were conducted via mask/snorkel dives from 9/3-9/19/96, 9/15-9/19/97, and twice in 1998 (8/10-8/14 and 10/5-10/9). Snorkel counts began in the uppermost tributary reaches and ended at the New River/Trinity River confluence. Tributary reaches were divided into two sections and snorkeled concurrently by two crews. The mainstem New River was divided into nine sections (Figure 2) with multiple sections snorkeled in consecutive days. Steelhead >36 cm (14 inches) were considered adults and those under 36 cm as half-pounders. Chinook >59 cm (22 inches) were counted as adults with smaller fish considered jacks.

Chinook redd surveys were conducted twice in FY 1996 (10/21-10/24/96 and 11/4-11/7/96). In FY 1997, redd surveys began on 10/9 and then every other week through 11/18/97. In FY 1998, surveys began on 10/5 and then every other week through 11/19/98. Except for a one-time check (10/20/97) of the first 5 rkm's of Virgin and Slide Creek, all other redd surveys were conducted only on the mainstem New River. Chinook tended to spawn in the same locations year after year, and areas with little spawning habitat (East Fork to Quinby Creek) were spot checked or surveyed only once during a given year.

Juvenile Emigration Monitoring

A 2.44 m diameter rotary trap (Figure 3) was deployed in the same location (rkm 3.75) in late March or early April each year, and an attempt was made to operate the trap seven days a week through July. The actual rotary trap monitoring periods using a 2.44 m trap were 3/26-7/19/96, 4/1-7/11/97, and 4/8-7/22/98. To trap through July, a 1.52 m diameter trap was substituted for the larger trap from 7/12-7/28/97 and 7/23-7/31/98. The trapping period was not extended in 1996.

A sampling day was the time between setting the trap and the removal of all captured fish the following day. Trap checks typically occurred between 0930 and 1200 hours. Fish were netted, placed in 19-liter (5-gallon) buckets and anesthetized with tricaine methanesulfonate (MS-222). A single fish was used to test the strength of the anesthesia and thereafter 5 to 15 fish were anesthetized as a group. Captured adult steelhead were not anesthetized. Adult fork lengths (FL) were estimated and the fish was immediately released.

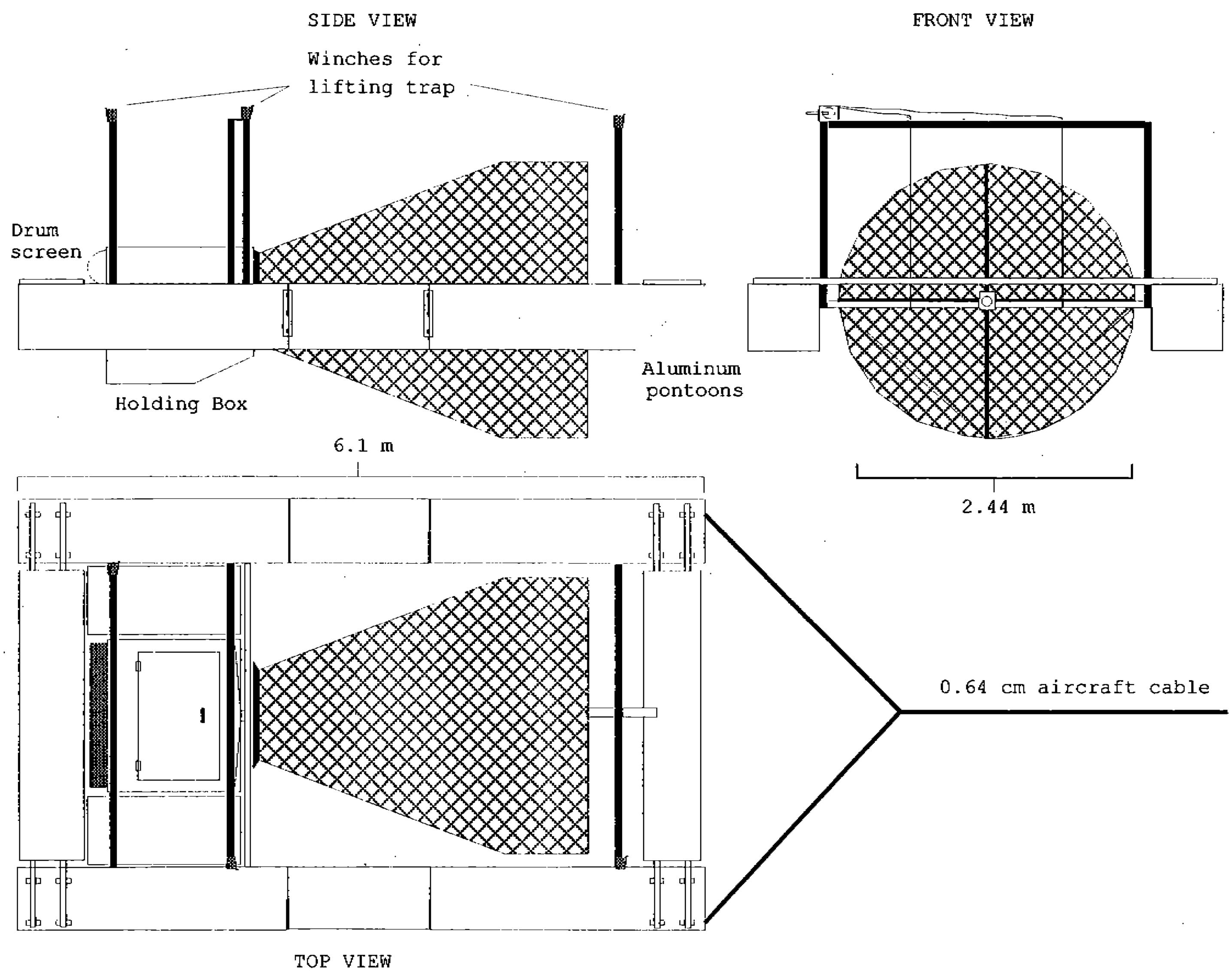

Figure 3. Rotary screw trap design depicting key components and dimensions.

Random samples of up to 50 juvenile fish per species and development code were measured to the nearest mm. Due to an inconsistency in personnel, fish development stage was recorded differently each year. For 1996 and 1997, fish displaying faint or absent parr marks, silvery coloration, black caudal-fin margin, and loose scales were categorized as a " smolt" and all others as " parr" . Development stage was not recorded during the first 33 trap days of 1998, and when resumed, a pre-smolt category was added.

Scales samples for age analysis were collected primarily from juvenile steelhead. Scales were removed from between the dorsal fin and lateral line with a pocketknife. The frequency of scale collection varied each year with samples taken from up to 15 parr and 15 smolt each day in 1996. In an effort to reduce stress to fish, scale sampling frequency in 1997 was reduced to once a week (Thursday) from all measured fish. In 1998, all fish larger than 60 mm during the first few weeks of trapping were sampled. Thereafter, scales were collected from outliers depicted on a length-frequency histogram. A catch database updated daily automatically adjusted the length-frequency distribution compensating for growth. Scale samples were mounted on microscope slides and ages were determined with the aide of a microfiche projector. Samples were aged twice independently and discrepancies were resolved by a third reader.

Daily catches of parr and smolt were ascribed ages (age 0-3) and summed by Julian Week (JW) (Appendix A). Catch totals given are actual number of fish captured and handled. Given similar trapping effort (consistency in trap placement, trap size, days trapped) and juvenile emigration patterns, weekly and annual abundance index totals are a method of comparing emigration magnitude (year-class strength) and emigration timing trends between years. Weekly emigration abundance totals were based on daily abundance index totals and daily abundance index estimates for days not sampled. Daily abundance totals ($Index_d$) were calculated per species and age classes using the following equation:

$$Index_d = Catch_d / (Q_s / Q)$$

Where: $Catch_d$ = daily catch by species and age class
Q_s = volume of river discharge sampled (cfs)
Q = daily river discharge (cfs)

Stream velocities entering the trap were measured and recorded each trap day. In 1996 and 1997 a Price AA current velocity meter and top-setting rod were used to measure velocity. A General Oceanics digital flow meter (Model 2030) was used in 1998. Both instruments provided comparable estimates of velocity. Velocity measurements were taken directly in front of the cone at three stations (right, center, left) and at 0.2 and 0.8 of the cones operating depth. The area (f^2) of each cell were multiplied by its corresponding average water velocity (f/s) to determine volume sampled in cubic feet per second (cfs).

A stream gauge at rkm 3.4 was used to estimate Q. Gage height was recorded daily during the trap season. Gauge height and the corresponding Q were estimated utilizing the following gage/flow relationship established by AFWO in 1990 (USFWS 1991):

$$Q= \{10^{[1.35 + 3.05(\log(X+1))]}\}-1,$$

$$X= \text{gauge height (feet)},\ Q= \text{discharge (cfs)}$$

For days not sampled and/or having had a fouled set (cone rotation ceased), daily abundance was estimated by averaging the abundance values of two days prior to and two days after the day/s not sampled. Weekly abundance indexes represent the sum of daily abundance and were calculated by Julian Week. For Julian Weeks not completely sampled at the beginning and end of the trapping seasons, the nearest two days of abundance index values were used to generate index estimates for non-sampled days within the Julian Week.

Stream Discharge and Water Temperatures

Mr. Roger Eckert of Five Waters Ranch collected stream discharge from 11/14/95 through 3/26/96. The Five Waters gage was read 2 to 4 times a week until the start of rotary trapping, after which gage readings occurred daily through July. Daily water temperature data were recorded in two hour intervals using a Ryan Instruments digital recorder (Model #RTM) located adjacent to the stream gage. Temperature data at Five Waters were recorded from 3/31-11/22/96, 3/15-12/24/97, and 1/4-9/18/98. Daily maximum, minimum, and mean water temperatures were calculated between 0100 and 2400 hours.

Water temperature monitoring expanded in 1997 to include seven index reaches, the mouths of New River, Big Creek and Devils Canyon, and in the mainstem Trinity River just upstream of New River (Figure 4). A total of twelve Onset Corp. Optic StowAway temperature recorders were deployed at these location in mid-May 1997. Each temperature recorder was secured within a 5.3 x 30 cm PVC tube anchored to a rock at a depth of ~0.9 m. All twelve recorders were retrieved and downloaded in September 1997.

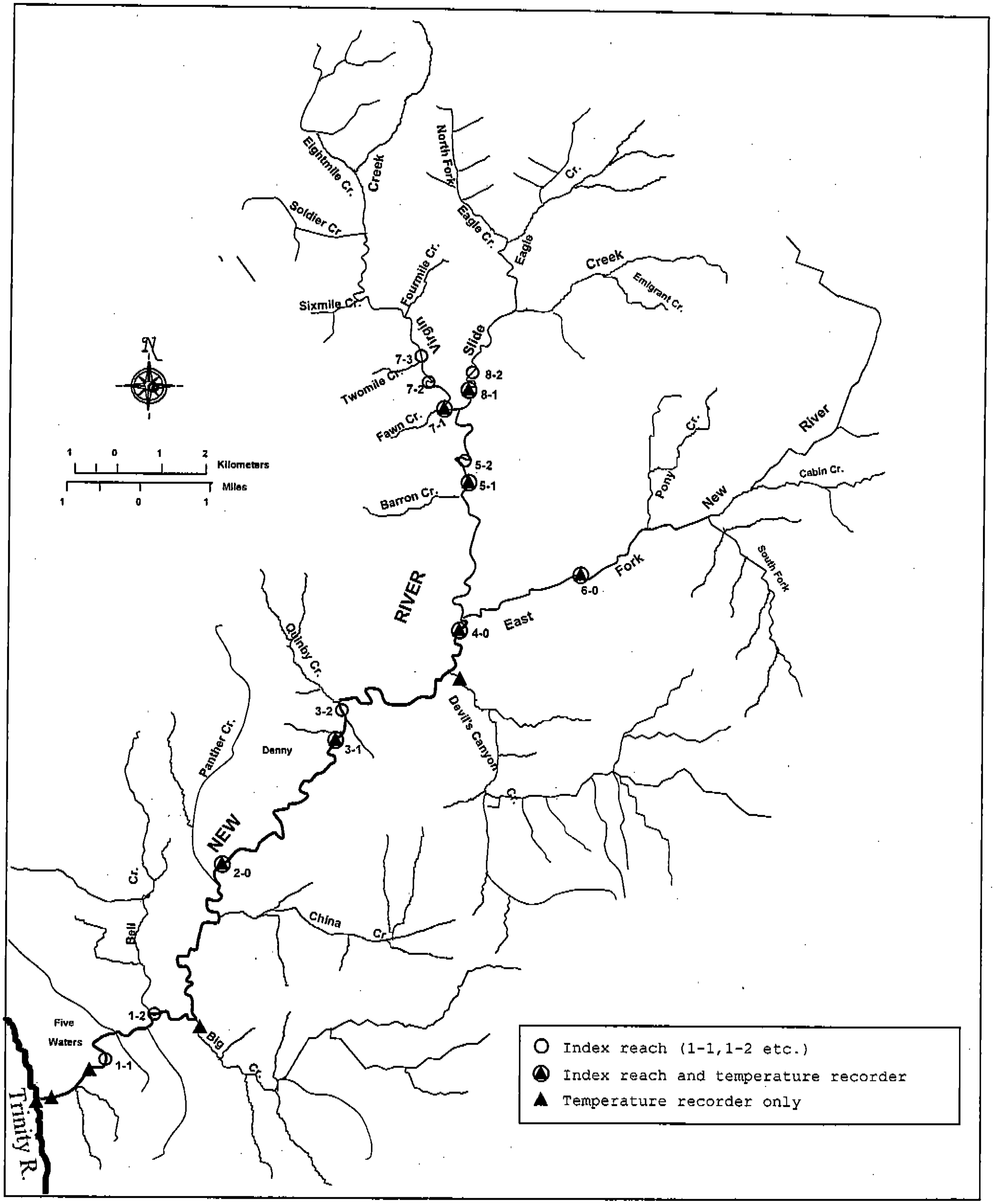

Figure 4. Location of index reaches and temperature recorders on New River and its major tributaries.

Seven temperature recorders were redeployed in mid-May 1998. The 1997 sites that did not receive a recorder in 1998 included the mainstem Trinity River, the mouths of New River and Big Creek, and index reach 3-1. A temperature recorder was deployed at the mouth of Devils Canyon but malfunctioned. Temperature recorders were retrieved and downloaded in September 1998.

Index Reaches and Juvenile Over Summer Rearing

Fourteen index reaches established in 1989 (USFWS 1991) were re-habitat typed and snorkeled each year at low summer flow. Eight index reaches occur on the mainstem New River (1-1,1-2,2-0,3-1,3-2,4-0,5-1,5-2), one on East Fork (6-0), three on Virgin Creek (7-1,7-2,7-3), and two on Slide Creek (8-1,8-2) (Figure 4). Index reaches were habitat typed using the modified McCain et al. (1990) methodology. Habitat typing occurred in the week preceding snorkel counts. The bottom and top of each mesohabitat unit was flagged and marked by stacked cobble. Snorkel counts occurred 7/29-8/12/96, 8/4-8/7/97, and 9/14-9/18/98.

Each mesohabitat was snorkeled upstream in succession beginning from the lowermost downstream unit. Counts were conducted during daylight hours and represent fish actually observed. Measures were not taken to determine the number of fish present but not observed, nor were crew ability/inability to see fish calibrated. Juveniles were tallied per species and age class (Age 0-3). The approximate length per age class was adopted from rotary trap length-frequency/age distributions.

One swimmer snorkeled narrow mesohabitat units (< 2 m wide) with fish counts repeated once. Snorkel counts by 2 or 3 swimmers occurred where stream width permitted. These units' counts were not repeated. When fish aggregated at the top of a unit, each swimmer counted fish only within a pre-assigned age class. Fish larger than age 3 but smaller than half-pounders, were considered resident trout.

After an entire index reach was snorkeled, width measurements were taken at the bottom, ¼, ½, ¾, and top of each unit length. Depth measurements occurred at ¼, ½ and ¾ increments of all measured widths. Unit mean width and depth were derived from these measurements. However, maximum depth was measured where it occurred. Additional information recorded including percent unit cover, dominant/subdominant unit cover type (bank, small woody debris, large woody debris, terrestrial vegetation, surface turbulence, boulders, bedrock ledges, depth), and unit substrate type (bedrock, boulder >30.0 cm, cobble 30.0-8.0 cm, gravel 8.0-0.5 cm, sand 0.5-0.01 cm, and fines <0.01 cm). Dominant/subdominant substrate types were recorded from 1990-1997. In 1998, unit substrate types were recorded as a percentage and could constitute more than two substrate types. However, dominant/subdominant substrate types could still be derived.

Species age class densities (fish/m^2) were derived per mesohabitat unit and index reach. Age class density distributions were not normally distributed and received a square root transformation prior to further analysis. Due to the inherent subjectivity of habitat typing, all mesohabitats were grouped into their respective macrohabitat category (riffle, run and pool). Because fewer than two riffle, run or pool mesohabitat types sometimes occurred within a given index reach, macrohabitat density transformations were further grouped by basin area, i.e. the lower New River, upper New River, East Fork, Slide Creek and Virgin Creek. Mainstem New River groupings stemmed from the observation that for age 0 steelhead, consistent differences occurred annually in the mean density between the lowest mainstem index reaches (1-1, 1-2, 2-0, 3-1, 3-2) and the remainder of the index reaches (Figure 5). Index reaches 1-1 to 3-2 were grouped as the lower New River (Lower NR), reaches 4-0 to 5-2 were grouped as the upper New River (Upper NR). The tributary reaches were grouped by their respective name i.e. East Fork, Slide Creek and Virgin Creek.

Age class density transformations were compared by year and macro-habitat type. The NCSS statistical software version 6.0, split-plot design was used to calculate interactive lease squares mean densities by age, year (1990 to 1998), index reach group (Lower NR..etc.) and macrohabitat type (riffle, run, pool). Statistical significance between year, stream reach and macrohabitat types was not applied because fish counts were not statistically bounded within confidence intervals. Collapsing macrohabitats into respective mesohabitats did reduce subjectivity between habitat typing crews, but other sources of year to year variability (actual numbers of fish verses fish observed) could not be accounted for.

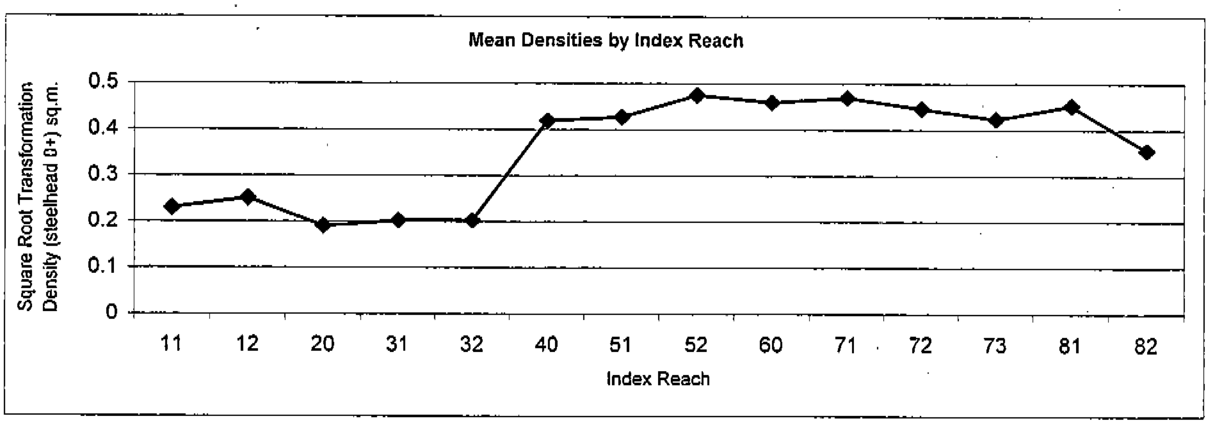

Figure 5. Age 0 steelhead mean densities by index reach, 1990-1998.

RESULTS AND DISCUSSION

Adult Summer Steelhead Counts

Summer steelhead begin their upstream migration between May and October in a sexually underdeveloped state and over-summer inriver prior to spawning in January and February (Barnhart 1986). Adult summer steelhead enter New River as early as June, but most do not reach the pools in which they will over-summer until August (Freese 1982). New River summer steelhead surveys have occurred in either September or October since 1989. During the past ten years, adult summer steelhead counts have ranged from 251 to 765 fish, averaging 480 fish. Over the same period, half-pounders represented between 1.4 and 24.0 percent of all summer steelhead counted. For 1996-1998, counts of summer steelhead were 307, 651, and 495 fish respectively (Table 1), with half-pounder percentages of 18, 7, and 1.4 respectively.

Many New River tributaries are not accessible to adult summer steelhead due to either falls or low flow (physical barriers) at their confluence. Other portions of New River tributaries have not been surveyed due to time constraints, even though summer steelhead could possibly hold in these areas. Areas not surveyed include Slide Creek (upstream of Eagle Creek and North Fork Eagle Creek confluence), Virgin Creek (upstream of Soldier Creek) and on the East Fork (South Fork of the East Fork (SFEF)), Cabin Creek, and the East Fork upstream of the SFEF confluence) (Figure 6). Excluding these areas does not likely detract significantly from the overall run-size estimate. This is based on the fact that over the last ten years, 88 to 99 percent of all adult summer steelhead observed were within the New River mainstem.

Anecdotal information suggests summer steelhead do over-summer in the SFEF. Past CDFG surveys (CDFG New River Field notes), and Freese and Taylor (1979), acknowledge that the stream is suitable for spawning. Freese and Taylor (1979) also noted the SFEF is probably most important to winter steelhead. Spawning gravel was reported scarce on the East Fork upstream of Cabin Creek. Freese and Taylor (1979) observed one summer steelhead in the East Fork approximately 0.4 rkm upstream of the Cabin Creek confluence. This fish was upstream of a 2.4 m falls formerly considered a barrier (CDFG biologist Thomas, 1973 field notes). A 3.0 m falls occurs on Eagle Creek downstream from the confluence with the North Fork of Eagle Creek, but it does not pose a barrier to summer steelhead. This falls is associated with a deep pool and adults have been observed upstream during past FWS surveys. A summary of the Freese and Taylor (1979) narrative of New River and its tributaries, including water temperature, barrier locations, and presence/absence of summer steelhead habitat is included as Appendix B. A compilation of the available habitat and barriers known to the Arcata Fish and Wildlife Office (AFWO) are presented in Figure 6.

Table 1. Adult summer steelhead and spring chinook survey results, 1989-1998.

				Virgin Cr.		Slide Cr.		East Fork		Mainstem New River						
Survey dates	Species	Soldier Creek to Fourmile Creek	Fourmile Creek to confluence pool	N.F. Eagle Creek to mouth of Eagle Creek	Mouth of Eagle Creek to confluence pool	South Fork to Lucky Lukes	Lucky Lukes to mouth of East Fork	Confluence pool to Barron Creek	Barron Creek to East Fork confluence	East Fork confluence to Footbridge	Footbridge to Denny campground	Denny campground to Panther Creek	Panther Creek to Bell Creek	Bell Creek to Trinity River	Totals	Total Steelhead
09/12-09/27/89	Spring chinook	0	0	0	0	NS	NS	0	1	5	1	3	1	6	17	
	Steelhead adult	5	1	7	9	NS	NS	103	114	143	105	48	19	110	664	
	half-pounder*	5	4	0	5	NS	NS	1	2	0	5	8	4	1	35	699
09/04-09/12/90	Spring chinook	0	0	0	0	0	0	1	0	0	3	0	2	6	12	
	Steelhead adult	10	2	20	18	8	2	31	18	50	46	17	60	61	343	
	half-pounder	1	1	1	0	2	1	0	6	2	6	4	10	4	38	381
09/03-09/12/91	Spring chinook	0	0	0	0	0	0	0	0	0	0	0	1	1	2	
	Steelhead adult	40	7	8	6	3	0	74	82	93	167	16	109	97	702	
	half-pounder	2	16	0	10	1	0	2	2	2	1	0	7	3	46	748
09/15-09/23/92	Spring chinook	0	0	0	0	0	0	0	0	0	1	0	8	9	18	
	Steelhead adult	0	2	0	0	0	0	44	0	73	65	12	52	24	272	
	half-pounder	0	0	0	0	0	1	4	1	5	15	11	30	19	86	358
09/07-09/16/93	Spring chinook	0	0	0	0	0	0	0	10	0	4	11	1	5	31	
	Steelhead adult	5	25	5	0	1	0	79	41	36	36	45	45	50	368	
	half-pounder	0	3	1	1	0	0	3	10	3	10	12	15	1	59	427
09/12-09/16/94	Spring chinook	0	0	0	0	0	0	0	10	0	1	0	1	4	16	
	Steelhead adult	1	6	0	2	0	0	10	16	5	27	27	125	185	404	
	half-pounder	0	0	0	0	1	0	0	0	0	9	7	0	6	23	427
09/05-09/21/95	Spring chinook	0	0	0	0	0	0	0	1	1	6	1	4	8	21	
	Steelhead adult	34	30	4	19	5	5	117	123	75	68	39	51	195	765	
	half-pounder	0	0	0	0	1	0	0	1	7	8	7	15	0	39	804
09/03-09/18/96	Spring chinook	0	0	0	0	0	0	0	8	1	5	8	4	19	45	
	Steelhead adult	0	3	4	0	3	2	29	35	31	19	38	44	43	251	
	half-pounder	5	1	1	0	0	2	3	10	1	5	11	10	7	56	307
09/15-09/19/97	Spring chinook	0	0	0	0	0	0	1	0	1	3	4	14	17	40	
	Steelhead adult	12	20	4	9	3	0	32	97	100	36	21	94	177	605	
	half-pounder	1	0	0	1	0	0	7	4	7	2	8	12	4	46	651
10/05-10/09/98	Spring chinook	0	0	0	0	0	0	0	0	2	3	0	8	7	20	
	Steelhead adult	13	5	3	7	3	0	15	5	31	71	9	77	180	419	
	half-pounder	1	2	1	2	1	1	1	5	17	7	7	28	3	76	495

* half-pounders or sexually immature steelhead having spent one to three years rearing in freshwater and less than one year in the ocean before making their first upstream migration.

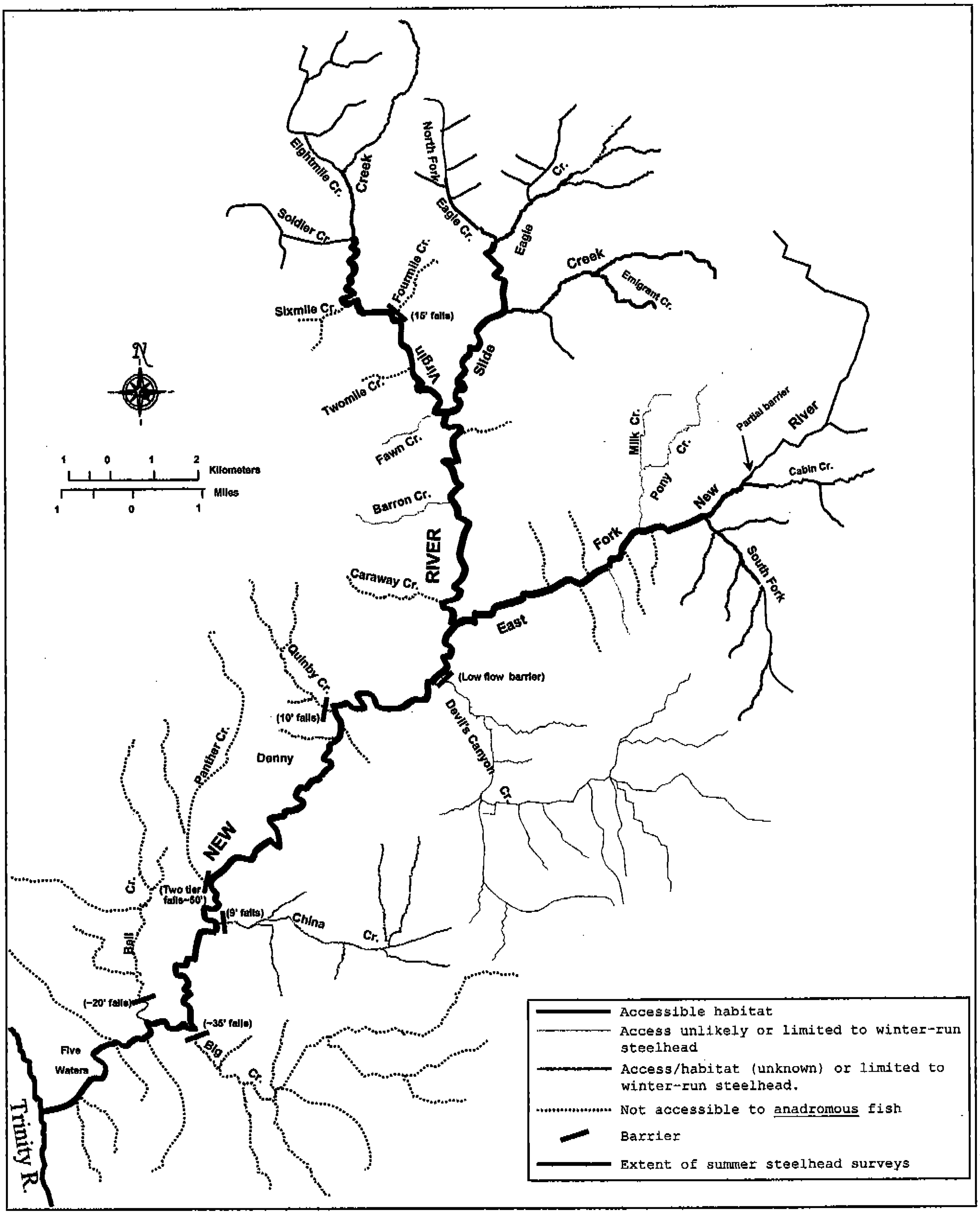

Figure 6. Distribution of summer steelhead habitat in New River and major tributaries.

Adult Spring Chinook Counts

Spring chinook salmon life history involves adults migrating to the upper reaches of their natal stream during spring and early summer (Barnhart and Hillemier 1994). Adults hold in deep, cold, permanent pools from June through September prior to spawning (Leidy and Leidy 1984; Barnhart and Hillemier 1994). New River spring chinook counts were conducted in conjunction with summer steelhead surveys (Table 1), and all spring chinook were observed only within the New River mainstem.

New River spring chinook counts for 1996-1998, were 45, 40, and 20 fish respectively. Annual spring chinook counts on New River over the last ten years (1989 to 1998) have ranged from 2 to 45 fish, averaging 22 fish (sd=13.0). In comparison, spring chinook counts on the Salmon River (Klamath River tributary) over the same period have ranged from 148 to 1,249, averaging 731 (sd=519.7). South Fork Trinity River counts for the eight years (1991-1998) ranged from 66 to 1,097 fish, averaging 408 fish (sd=346.2). Larger numbers of spring chinook occur upstream of Junction City, but these counts are largely influenced by chinook of Trinity River Hatchery origin.

Chinook Redd Surveys

Spring chinook spawning usually begins in the latter part of September and continues through October (Barnhart and Hillemier 1994). Leidy and Leidy (1984) describe the spring chinook spawning period in the Trinity River system as September through November. Fall chinook have been recorded in the mainstem Trinity River as early as July but generally do not enter the larger tributaries until September and October. Spawning begins in October and continues through December (Leidy and Leidy 1984). It is believed that all chinook spawning in New River occurs in the mainstem river. However, locals have referred to a run of " coho salmon" that used to enter tributaries in July. This anecdotal information may suggest that a larger run of salmon, most likely spring chinook, may have occurred in New River historically. And although chinook have not been observed in the tributaries during our surveys, at least one chinook jack was observed in Virgin Creek during the fall months in the mid-1990's (Kautsky, personal communication, 1998).

Prior to FY-97, annual counts of chinook redds have ranged from 6 to 53, for a total of 134 redds (Table 2). Of these 134 redds, 68 were attributed to spring chinook and 66 to fall chinook. The two parameters used to distinguish between a spring and fall chinook redd were location (upper or lower basin) and the time of year (October verses November).

Table 2. New River redd survey results, FY 1989-1996.

Fiscal Year	Spr. Chinook Redds	Fall Chinook Redds	Totals
1989	10	6	16
1990	14	0	14
1991	7	4	11
1992	3	3	6
1993	3	7	10
1994	28	25	53
1995	3	21	24
1996	Survey not conducted		
Totals	68	66	134

FY-97: Chinook redd surveys were conducted on New River twice in FY-97 (Table 3). A total of 70 redds were counted from 10/21 to 10/24/96. Sixty-two percent of these redds were found within the first 12.1 rkm's (New River mouth to Panther Creek) (Figure 7). Spawning also occurred between Quinby Creek and the Denny Campground, and between the East Fork confluence and the Virgin/Slide Creek confluence. Based on run timing it is thought that these fish were likely all spring chinook. In a conversation with CDFG biologist Mark Zuspan, he too was of the opinion that these fish were probably spring-run fish (Zuspan, personnel communication, 1996). A second survey was conducted from 11/4 to 11/7/96, and an additional 34 new redds were located. Fifty percent of these new redds occurred within the first 3.5 km. In total, 104 chinook redds were counted in FY-97, which was significantly higher than the eight year average (36) from FY-89 through FY-95 (no survey conducted in FY-96).

Table 3. Chinook redd survey results, FY 1997.

FY-97	Redd survey dates (new redds)					
Reach	10/21 to 10/24	11/04 to 11/07	No other surveys conducted due to high flows			**Total**
Confluence - Barron Creek	8	2				**10**
Barron Creek - East Fork confl.	5	2				**7**
East Fork - Footbridge	3	2				**5**
Footbridge - Denny campground	8	1				**9**
Denny campground - Panther Creek	3	3				**6**
Panther Creek - Five Waters	29	8				**37**
Five Waters - Trinity River	14	16				**30**
Total	**70**	**34**				**104**

FY-98: Redd surveys were conducted in the upper New River between 10/9 and 10/13/97, with 4 redds counted between the East Fork confluence and a falls downstream of the Virgin/Slide Creek confluence. The upper mainstem above Barron Creek was surveyed again on 10/20/97, as were the first 5.0 rkm's of both Virgin and Slide Creek. Redds were not observed in any of these reaches. The remainder of the New River mainstem (Barron Creek to the Trinity River) was surveyed on 10/21 and 10/22/97.

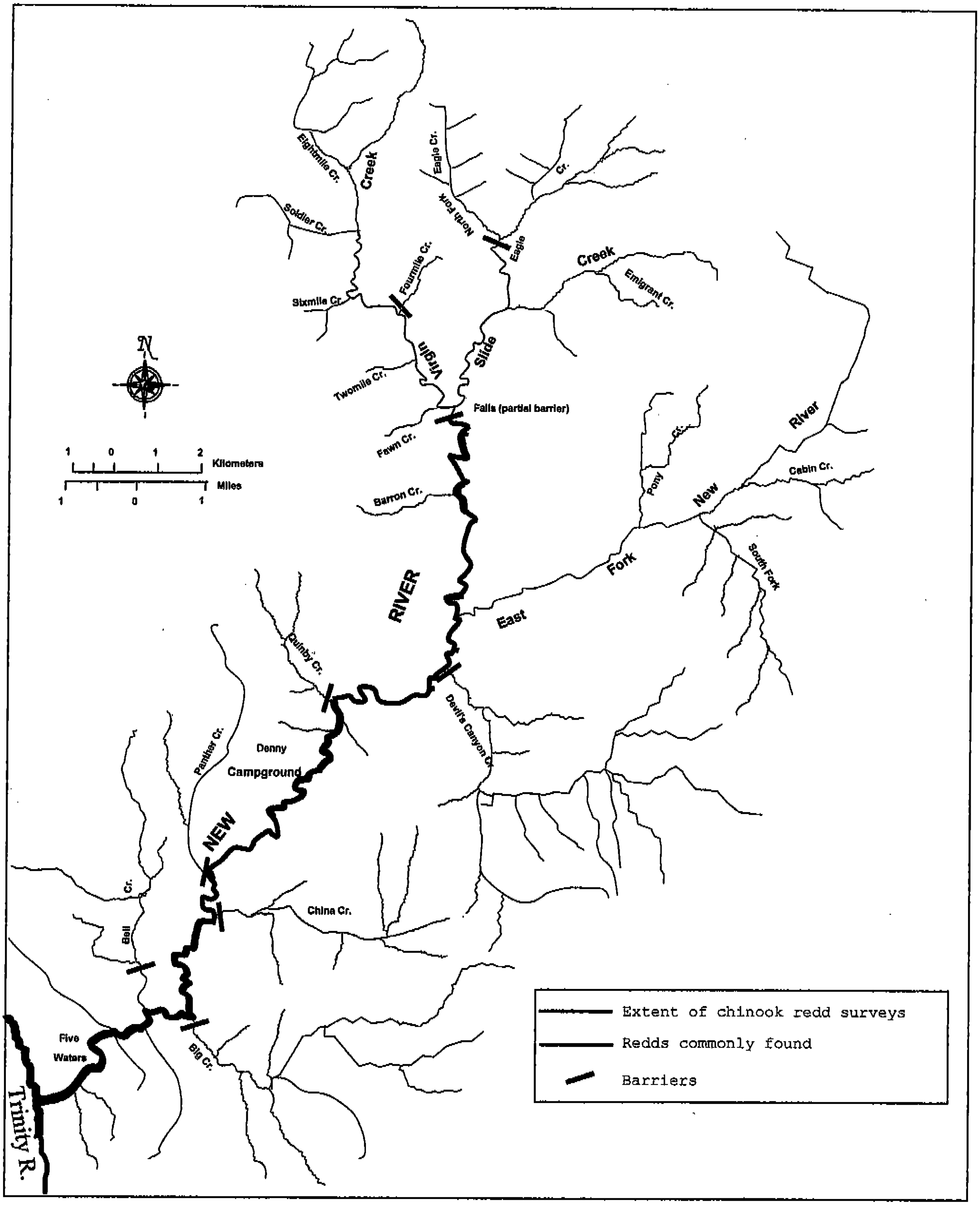

Figure 7. Extent of New River chinook redd surveys and common areas of chinook spawning.

Of the 126 redds counted in October, 38 percent (47) were counted within the first 3.4 rkm's of New River.

Two redd surveys were conducted (Virgin/Slide Creek confluence to Trinity River) in November 1997 (Table 4). A total of 55 new redds were observed. Of these, 78 percent (47) were located within the first 3.5 rkm's of New River. Redds in this reach were constructed in most locations where gravel aggregated in areas of appropriate water velocity, including those at depths of up to 2.4 m. In all, approximately 181 redds were observed in FY-98, which represents the largest number counted in any one year during this study. Redds were observed throughout the New River mainstem, with over 50 percent having occurred within the first 3.5 rkm's. Redd superimposition was most prevalent within the first 1.0 to 1.5 rkm's, and thus the reason for estimated counts.

Table 4. Chinook redd survey results, FY 1998.

FY-98	Redd survey dates (new redds)					
Reach	10/09	10/14	10/20 to 10/22	11/04 to 11/06	11/18 to 11/19	Total
Confluence - Barron Creek	3	NS	0	0	0	3
Barron Creek - East Fork confl.	NS	1	8	4	0	13
East Fork - Footbridge	NS	NS	4	0	0	4
Footbridge - Denny campground	NS	NS	15	0	0	15
Denny campground - Panther Creek	NS	NS	18	0	0	18
Panther Creek - Five Waters	NS	NS	27	2	2	31
Five Waters - Trinity River	NS	NS	50	~47*	NS	~97
Total	3	1	122	~53*	2	~181

*~ Due to redd superimposition counts are estimates.
NS = No survey

FY-99: The AFWO and the HVT conducted chinook redd surveys in FY-99, although funding was not allocated from the TRFWRA. Chinook redd surveys were conducted every other week beginning in early October through mid-November 1998 (Table 5). In total, 11 redds were observed which is significantly lower than the preceding two years and redd distribution primarily occurred within the first 19.0 km (New River mouth to Denny). During the last survey in mid-November, five fresh chinook were observed holding within the lower 3.5 km. Although new fish likely contributed additional redds, the fact remains that the number of spawners entering New River in FY-99, was very low. Where fish had spawned on top of each other in FY-98, spawning was not observed, nor were fish holding near the mouth of New River waiting to ascend.

Table 5. Chinook redd survey results, FY 1999.

FY-99	Redd survey dates (new redds)				
Reach	10/05 to 10/09	10/19 to 10/21	11/02 to 11/04	11/19	Total
Confluence - Barron Creek	0	0	0	NS	0
Barron Creek - East Fork confl.	0	0	0	NS	0
East Fork - Footbridge	0	0	0	NS	0
Quinby Creek - Denny campground	0	1	0	0	1
Denny campground - Panther Creek	0	0	NS	1	1
Panther Creek - Five Waters	1	3	0	0	4
Five Waters - Trinity River	0	1	4	0	5
Total	1	5	4	1	11

NS = No survey

Adult Coho

Adult coho in New River have been poorly documented. Two adult coho carcasses were observed in the mainstem New River in December 1992, during the operation of an adult counting weir at Five Waters. This weir operated in 1992 and 1993, during which time no adult coho were captured. Except during the operation of this weir, AFWO has spent little time in New River during the period of coho spawning (late November to mid-January). The ability to conduct coho surveys is aggravated by high flows and poor visibility. Coho from Trinity River Hatchery were planted in New River in 1968 (USFWS 1991). Big Creek and the East Fork have been cited as New River tributaries historically having coho (USFS 1987, cited in Hassler et al. 1991). However, a 10 m falls restricts anadromous access to all but the first 0.5 rkm of Big Creek. The East Fork provides good to excellent coho habitat. A few juvenile coho were captured during rotary screw trapping during the spring of 1996 and 1997; indicating coho do use New River periodically.

Stream Flow and Water Temperature, FY 1996-1998

The highest discharge recorded for FY-96 occurred on December 29, 1995 (22,408 cfs). During juvenile emigration monitoring, the highest recorded discharge (4,213 cfs) occurred on April 24 1996. Median flow at Five Waters, April through July (1996), ranged from 954 to 149 cfs (Table 6). Summer base flow for August and September (1996) was approximately 72 cfs. Discharge data for FY-97 was limited to the period of juvenile emigration monitoring (April 2 to July 28, 1997). The highest discharge (1,436 cfs) was recorded on April 23, 1997. Median flow at Five Waters, April through July (1997), ranged from 404 to 109 cfs (Table 6). Summer base flow for August and September (1997) was based on four gage readings and ranged from 68 to 87 cfs. Discharge data for FY-98 was again limited to the period of juvenile emigration monitoring (April 8 to July 30, 1998), during which time the

Table 6. Median flow and mean water temperatures by month and year at Five Waters.

	Median flow (cfs)			Mean water Temperature (°C)		
Month	1996	1997	1998	1996	1997	1998
Apr	954	404	1014	8.9		8.5
May	712	365	734	10.8		9.5
Jun	281	198	668	14.8	16.3	13.2
Jul	149	109	197	20.1	19.6	19.7
Aug				19.7	20.7	20.2
Sept				16.2	17.3	20.4
Oct				11.9	11.2	
Nov					9.1	
Dec					5.1	

highest discharge (1,470 cfs) was recorded on May 2, 1998. Median flow at Five Waters, April through July 1998, ranged from 1,014 to 197 cfs (Table 6, Appendix C).

Water temperatures during periods of concurrent operation (May 15-September 15, 1996-1998) indicate cooler water temperatures occurred during spring 1998. Daily mean water temperatures in June 1996, 1997, and 1998, were 14.8, 16.3, and 13.2 respectively, and are indicative of flow conditions in June (Table 6, Appendix C). Maximum water temperatures occurred in July and August, where temperatures higher than 24°C generally occurred between 1400 and 1600 hours. For all three years there were 24-hour periods when water temperatures exceeded 20°C for two to four consecutive days at Five Waters. Rich (1987) reported water temperatures exceeding 20°C limits growth in salmonids. Maximum water temperatures generally decreased between 1600 and 0800 hours. Average daily water temperature for July and August were within 0.5°C all three years. Water temperatures for September 1998 were more than 2°C warmer than in September 1996, and September 1997, and were probably in response to lower stream discharge.

Water temperature data collected during July and August 1997 and 1998 depict cooler water temperatures higher in the basin (Figure 8). Cooler water flowing from the three major tributaries (Big Creek (rkm 6.3), Devils Canyon (rkm 24.3) and the East Fork (rkm 25.7)) as well as from the headwaters, Virgin and Slide Creek, provide areas of thermal refugia, and taken in the aggregate, help moderate mainstem water temperatures. During the warmest months in 1997 (July-September), inflow from Big Creek and Devils Canyon had the coolest water temperatures, followed by Slide Creek, Virgin Creek and the East Fork, respectively (Figure 9). Tributaries providing areas of cool water during the summer include Bell Creek (rkm 4.8), China Creek (rkm 10.1), Panther Creek (rkm 12.1), Quinby Creek (rkm 19.8), Caraway Creek (rkm 26.6) and Barron Creek (rkm 30.1).

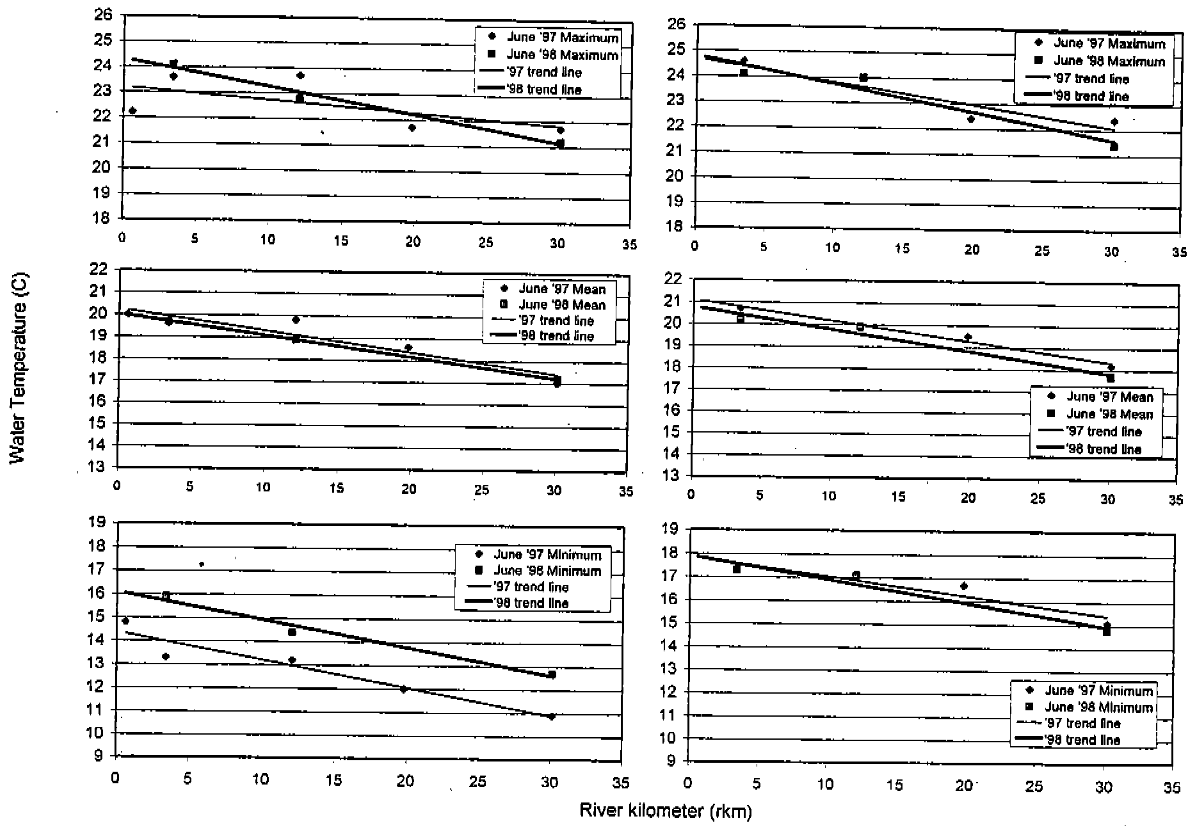

Figure 8. Maximum, Mean and Minimum water temperatures for the mainstem New River (mouth to Barron Creek) for July and August, 1997-1998.

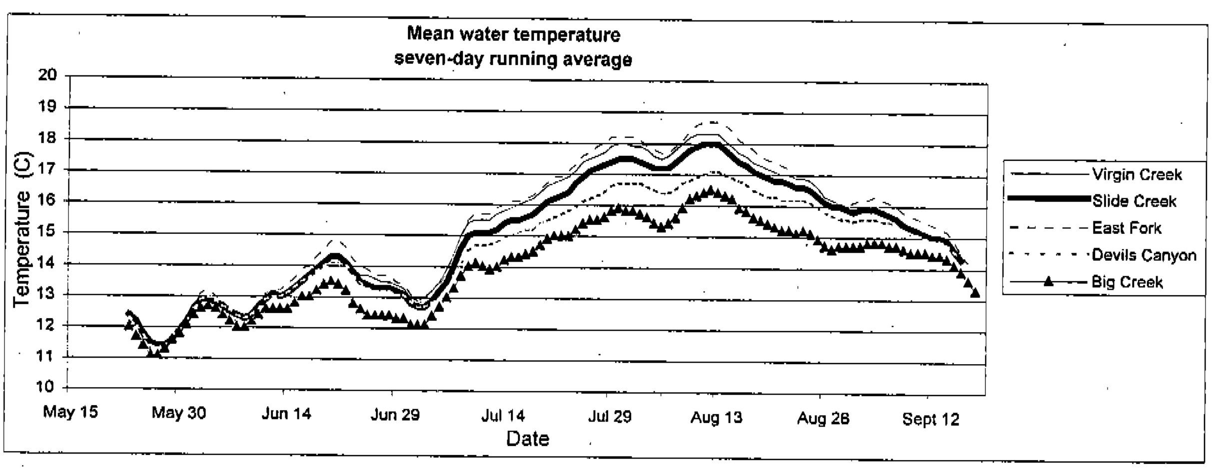

Figure 9. Mean water temperature for major New River tributaries, May 20 to September 15, 1997.

Juvenile Emigration Monitoring

Chinook Catches and Fork Lengths, FY 1996-1998

FY-96: From 3/26 to 7/19/96, 107 nights (92%) were effectively fished. Nine nights of trapping were missed due to high river flows and/or fouled sets. In total, 82 chinook (all age 0) were captured (Appendix D). The first chinook was captured April 9 (JW 15) and had a fork length of 57 mm. The smallest (37 mm) and largest (101 mm) chinook were both captured on June 21 (JW 25) (Appendix E). Mean weekly chinook FLs were variable throughout June (JW 23-26) due to low catch numbers (Figure 10).

FY-97: From 4/1 to 7/28/96, 105 nights (90%) were effectively fished. Twelve nights were not trapped due either to high flows, a fouled set, or mechanical problems. A total of 325 chinook (all age 0) were captured (Appendix F). The first chinook (45 mm) was captured April 12 (JW 15). Chinook FL peaked during JW 24 and averaged 84 mm (n=25, sd=5.4) (Figure 10, Appendix G). Thereafter, mean chinook FL declined slightly. Chinook were not captured after June 26 (JW 26).

FY-98: From 4/8 to 7/31/98, 109 nights (96%) were effectively fished. Five nights were not trapped due to a fouled set or unavailability of personnel (one weekend not sampled). A total of 333 chinook (all age 0) were captured in 1998 (Appendix H). Chinook were initially captured in mid-April (JW 17) and had a mean FL of 59 mm (n=3, sd=3.8). Only one chinook less than 50 mm was captured (JW 21) all season. Chinook FLs were greatest in JW 28 ($\bar{x}$=87, n=54, sd=6.9) (Figure 10, Appendix I).

Chinook Abundance Indices, FY 1996-1998

Annual chinook YOY abundance totals for 1996, 1997 and 1998 were 553, 1,974, and 1,520 respectively. The 553 for 1996 was one of the lowest abundance totals since the initiation of juvenile emigration monitoring in 1989. Chinook emigration in 1996 occurred from early April through late July (JW 15-29) (Figure 11). The timing of peak emigration was poorly defined due to the fact that no substantial increase (peak) occurred throughout the monitoring period.

Peak chinook emigration occurred mid-May in 1997 following decreased flow. A bi-modal emigration occurred in 1998 where an initial peak occurred in mid- to late May and a secondary peak in mid- to late June (Figure 11). Both peaks occurred during periods of decreased flow.

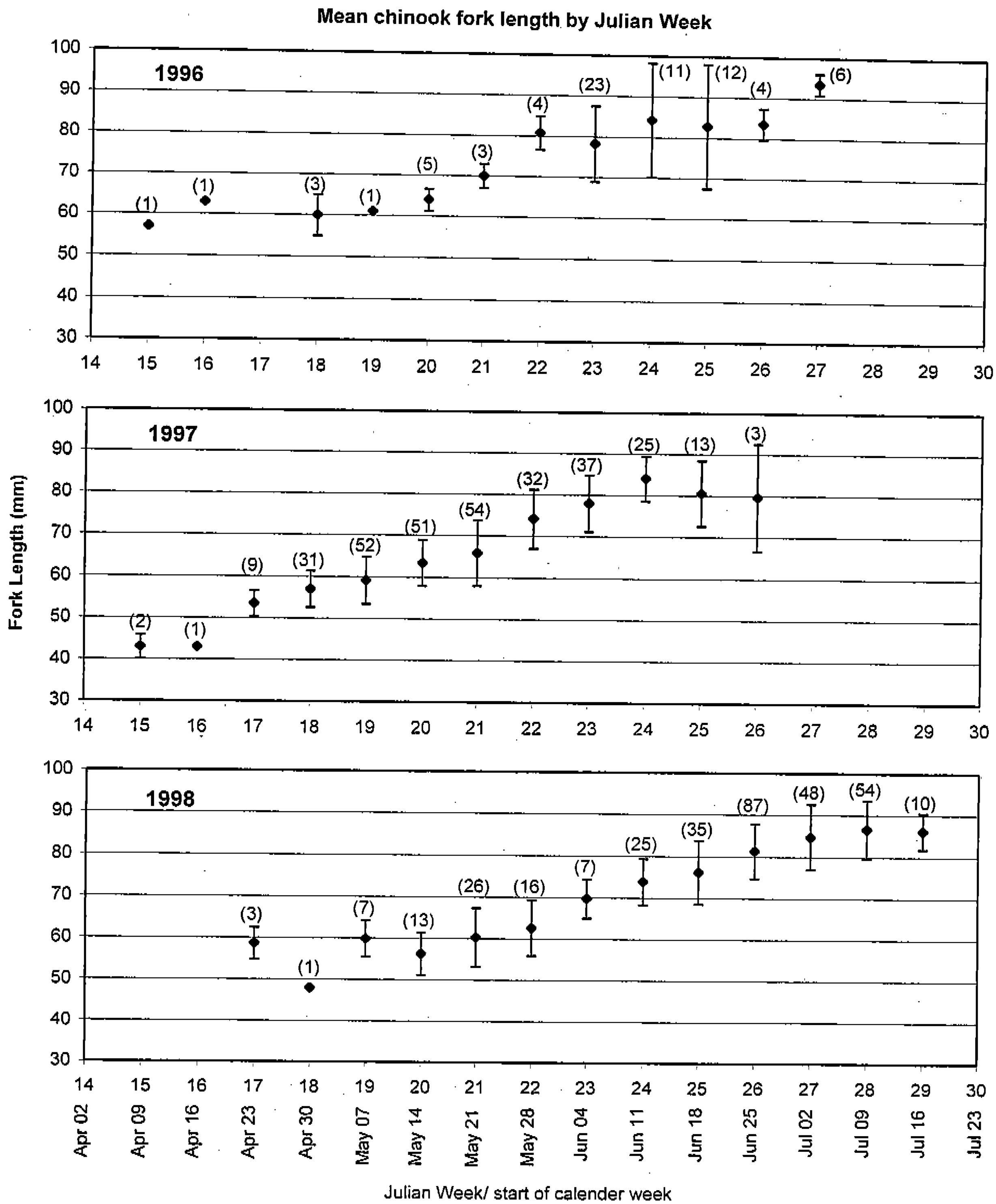

Figure 10. Weekly chinook mean fork lengths in rotary trap catches, 1996-1998. Bars show +/- one standard deviation. Parentheses enclose number measured (n).

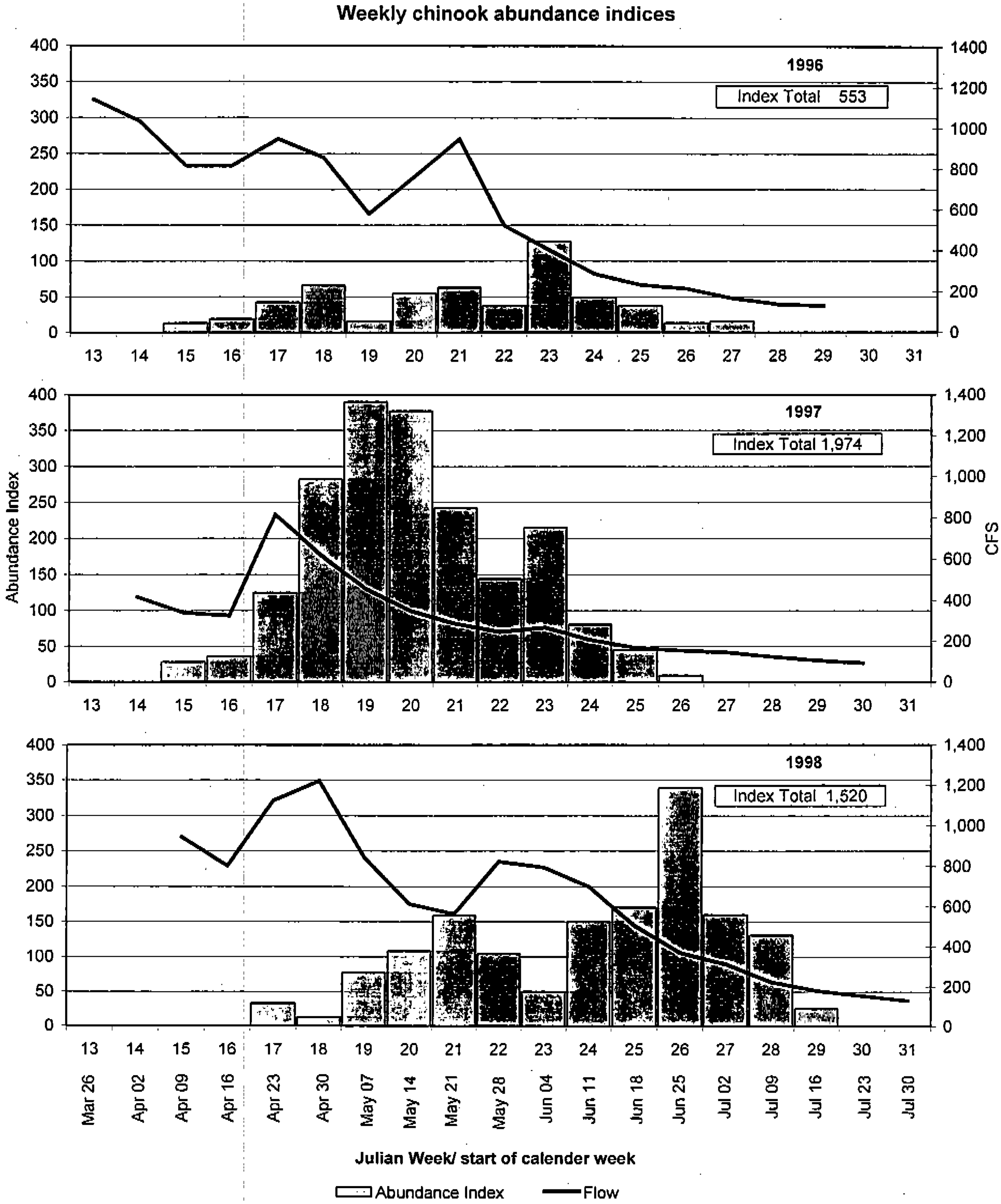

Figure 11. Weekly chinook abundance indices and mean river discharge at Five Waters, 1996-1998.

Chinook emigration occurred later in 1998 than the two previous years (Figure 12). More than 20 percent of the chinook emigration index was attributed to the month of July 1998, compared to less than 3 percent in July 1996, and 0 percent in July 1997 (no chinook were captured after 6/26/97). The later emigration in 1998 was probably due to lower water temperatures that would have delayed emergence of salmonid fry that year. Mainstem New River water temperatures measured in May at Five Waters Ranch were as much as 6.1 °C warmer in 1997 than 1998, and as much as 4.5 °C warmer in 1996 than 1998.

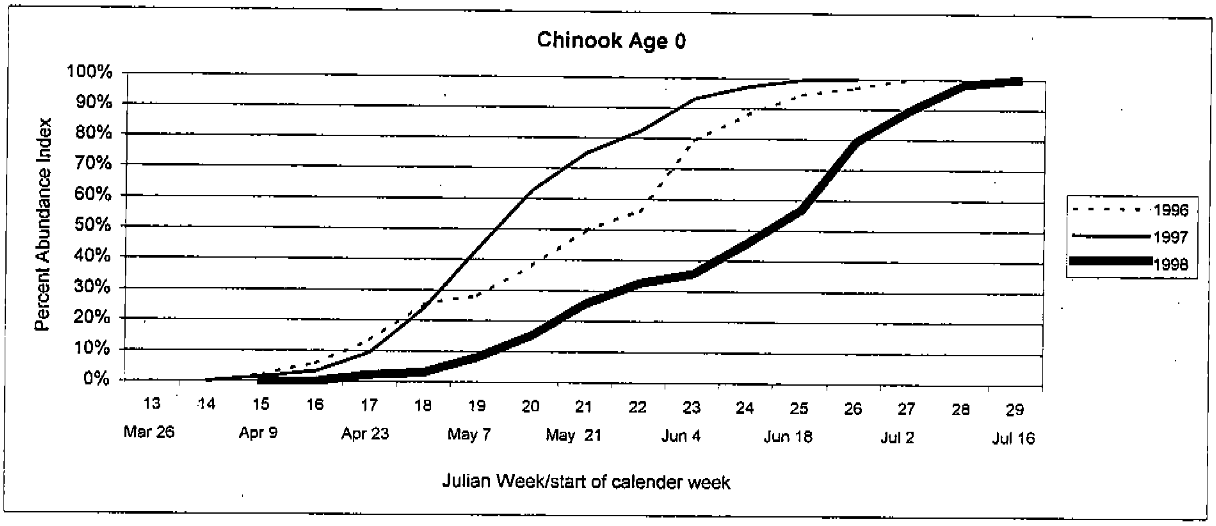

Figure 12. Cumulative portions of percent total chinook abundance index in rotary trap catches, 1996-1998.

Redd Counts and Annual Chinook Abundance Index Totals

Chinook redds observed in the fall and the chinook emigration abundance index totals the following spring (same fiscal year), showed a positive relationship between respective rankings (Table 7). In general, those years having average to above average redd counts did have relatively higher juvenile abundance index totals the following spring. However, the years having the largest number of redds counted did not produce the highest abundance index totals. This might be explained by high winter flows that occurred during 1997 and 1998 (the two years with highest redd counts) which likely produced scour and decreased egg-to-fry survival. Conversely, for 1989-1991, years with average redd counts, abundance index totals in the spring were relatively high, possibly due to higher egg-to-fry survival rates associated with milder winter flows.

Table 7. Chinook redd counts and subsequent juvenile abundance index totals, 1989-1998.

Fiscal Year	[1]Redd Count	Ranking	Nights trapped	Chinook YOY	Chinook Age 1	Totals	Ranking
1989	16	4	59	2,268	0	2,268	3
1990	14	5	95	3,807	0	3,807	1
1991	11	6	71	1,865	26	[2]1,391	6
1992	6	7	46	Trap damaged, too many days missed			
1993	3	8	82	656	0	656	7
1994	25	3	136	2,957	0	2,957	2
1995	3	8	88	0	0	0	9
1996	No survey		107	553	0	553	8
1997	74	2	106	1,974	0	1,974	4
1998	84	1	109	1,520	0	1,520	5

[1] Counts are for those redds occurring upstream of the rotary trap
[2] Total includes fish captured into August and September, however, these amounts are insignificant to the total index.

Coho Catches and Fork Lengths, FY 1996-1998

<u>FY-96</u>: Juvenile coho had not been captured in New River emigration monitoring prior to 1996. Eleven coho were captured in 1996, nine of which were YOY. Two coho were aged as 1+ fish (age 1), though no cohorts of this age class were captured as YOY in 1995. The first coho was captured on May 8 (JW 19) and the last on July 18 (JW 29). Coho FLs ranged from 43 to 82 mm (Appendix E).

<u>FY-97</u>: A total of nine juvenile coho (all YOY) were captured in 1997. The first was captured on April 17 (JW 16) and the last on May 31 (JW 22). Coho FLs ranged from 50 to 69 mm (Appendix G).

<u>FY-98</u>: Coho were not captured in 1998.

Coho Abundance Indices, FY 1996-1997

Annual coho abundance totals were 60 and 118 for 1996 and 1997 respectively. Yearling coho were captured only in 1996, and had an abundance index total of five.

Steelhead Catches and Fork Lengths

Steelhead Catches and Fork Lengths

FY-96: A total of 4,372 juvenile steelhead were captured in 1996. Of this total, 1,614 were age 0, 2,021 were age 1, 729 were age 2, and eight were age 3 fish. Age 1 and older juveniles were captured upon initiating trapping in late March (JW 13). Age 3 fish were all captured within the first three weeks of trapping (JW 13 to 15). The FLs of age 3 fish range from 181 to 228 mm (n=7). Weekly mean FLs for age 2 fish varied little from the initial catches in early April ($\bar{x}$=168, n=21, sd=22.4) through late May-early June ($\bar{x}$=164, n=45, sd=15.2). After this, both catch numbers per week and associated mean FLs deceased significantly (Figure 13). The FLs of age 1 fish ranged between 90 and 110 mm April through mid-July, with weekly mean FLs gradually increasing through the monitoring period. Catches of age 0 fish were few (12) and erratic from early April through mid-May. Age 0 FLs ranged from 26 to 80 mm with weekly mean FLs ranging from 32 mm (n=22, sd=5.9) to 52 mm (n=198, sd=6.4), mid-May through mid-July, respectively (Figure 13, Appendix E). Fish less than 30 mm were captured as late as June 11 (JW 24).

FY-97: A total of 7,270 juvenile steelhead were captured in the rotary trap in 1997. Of these, 2,845 were age 0, 2,944 were age 1, 1,461 were age 2, and 20 were age 3 fish. Nineteen age 3 fish were captured in April (JW 14-16) and one in June (JW 22). Fork lengths of age 3 fish ranged from 210 to 236 mm in April. The single age 3 fish in June had a FL of 248 mm. Fork lengths of age 2 fish ranged from 123 to 211 mm with little change in the weekly mean FL from early April through late May (JW 14-21) (Figure 13). Fork lengths of age 1 fish ranged from 55 to 141 mm, with weekly mean FLs gradually increasing from 82.5 mm (n=37, sd=11.6) during the first week of trapping (JW 14), to 119mm (n=7, sd=13.5) toward the end of July (JW 29). Fork lengths of age 0 fish ranged from 23 to 81 mm with weekly mean FLs ranging from 27 to 62.5 mm (Figure 13, Appendix G). Fish less than 30 mm were captured as late as June 4 (JW 23).

FY-98:.A total of 2,937 steelhead were captured during the 1998 season. Of these 1,231 were age 0, 1,139 were age 1, 561 were age 2, and 6 were age 3 fish. Five age 3 fish were captured in April (JW 15-17), and 1 in July (JW 28). Fork lengths of age 3 fish ranged from 194 to 259 mm in April. The single age 3 fish in July was 300 mm. Fork lengths of age 2 fish ranged from 124 to 227 mm, with weekly mean FLs ranging from 165 to 184 mm April through late May (JW 15-21), the period the majority of age 2 fish were captured. Fork lengths of age 1 fish ranged from 63 to 188 mm, with weekly mean FLs changing little April through May. Fork lengths of age 0 fish ranged from 24 to 84 mm, with weekly mean FLs increasing from 35 to 58 mm late May through July (Figure 13, Appendix I). Fish less than 30 mm were captured as late as July 2 (JW 27).

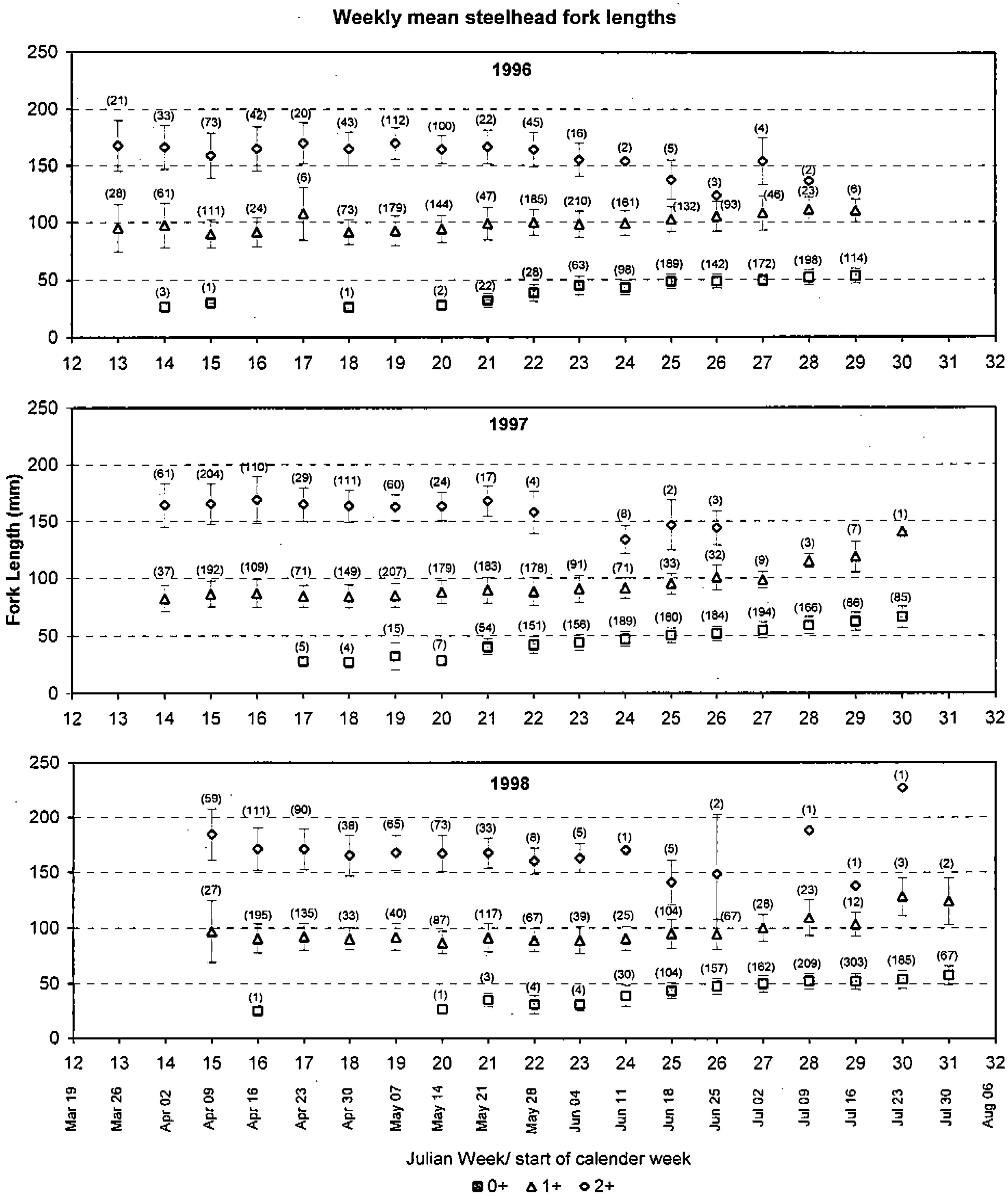

Figure 13. Weekly mean fork lengths for age 0, age 1 and age 2 steelhead in rotary trap catches, 1996-1998. Bars show +/- one standard deviation. Parentheses enclose number measured (n).

Steelhead Abundance Indices, FY 1996-1998

Typical late winter and early spring river discharge at New River precludes placement of a rotary trap until age 1 and older steelhead emigration is well underway. This truncates interpretation of early emigration trends of these age classes. Likewise, late portions of YOY emigration occur after the conclusion of the normal trapping period. However, in the typical trapping season, most YOY emergence has yet to commence at time of trap placement (early April) and age 1 and older steelhead emigration has largely abated by trapping season's end (late July) (Figure 14). Yearly variation in emigration timing can influence total abundance indices if significant portions of the emigration occur outside the trapping period. Interpretation and comparison of year to year emigration timing remains valid as long as inferences are limited to trends within common trapping windows.

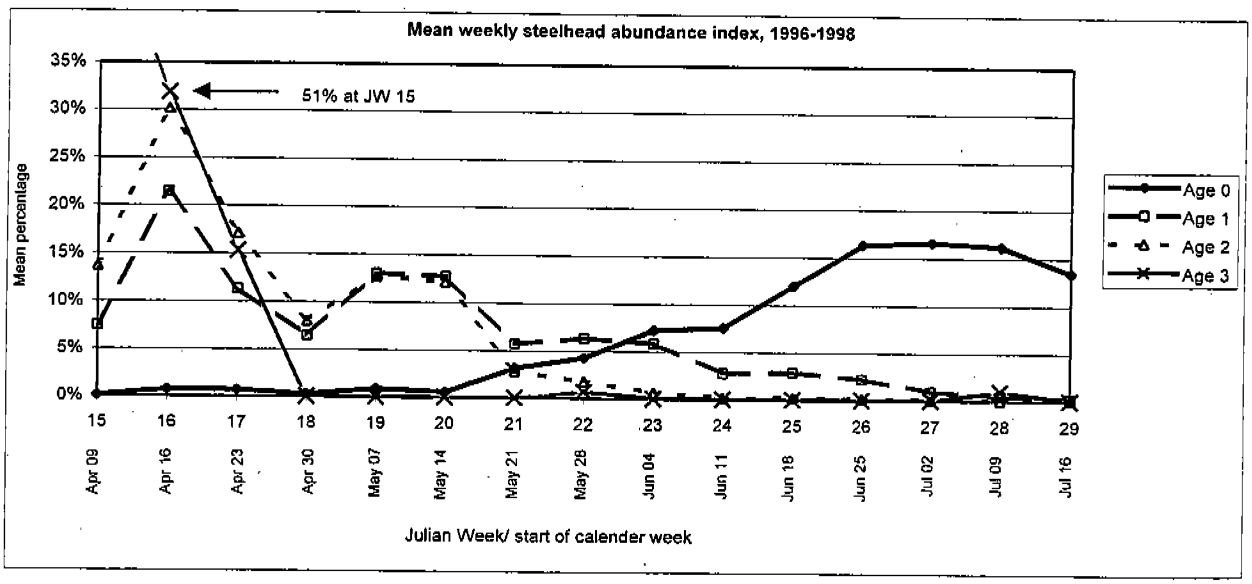

Figure 14. Mean percent of season's weekly steelhead abundance indices for the New River rotary trap, 1996-1998. Restricted to a common trapping period of Julian Week 15-29.

Emigration of YOY steelhead occurred later in 1998 than in the previous two years (Figure 15). This may have occurred due to lower water temperatures that would have probably delayed emergence of salmonid fry (Figure 16). Mainstem New River water temperatures measured in May at Five Waters Ranch were as much as 6.1 °C warmer in 1997 than 1998, and as much as 4.5 °C warmer in 1996 than 1998. The emigration trends of YOY steelhead in 1996 and 1997 were similar to each other. This inference for steelhead was restricted to observations made between April 9 and July 19 each year because many steelhead were captured outside this common trapping window.

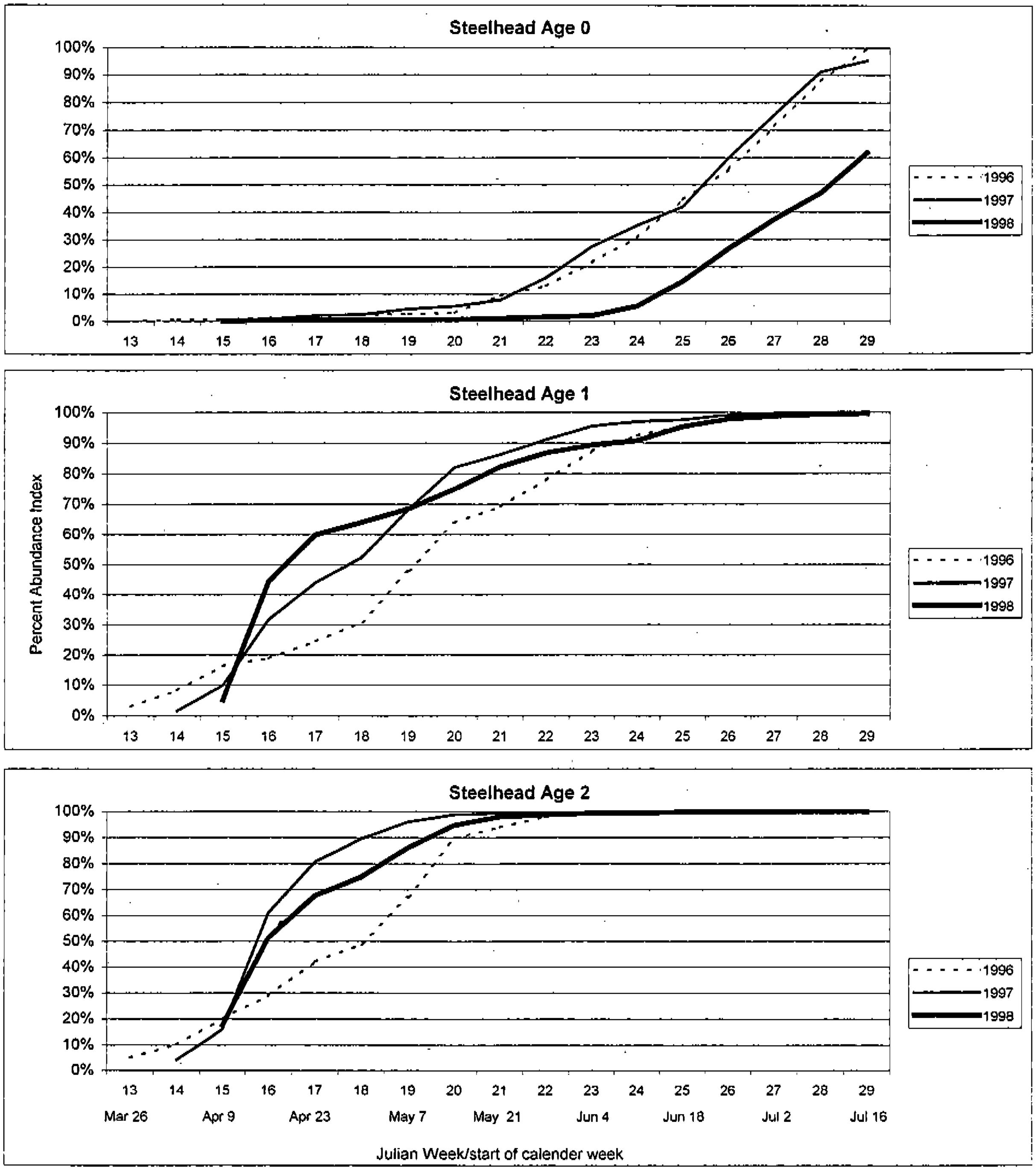

Figure 15. Cumulative portions of percent total steelhead abundance indices for New River rotary trap, 1996-1998. Restricted to a common trapping period of Julian Week 15-29.

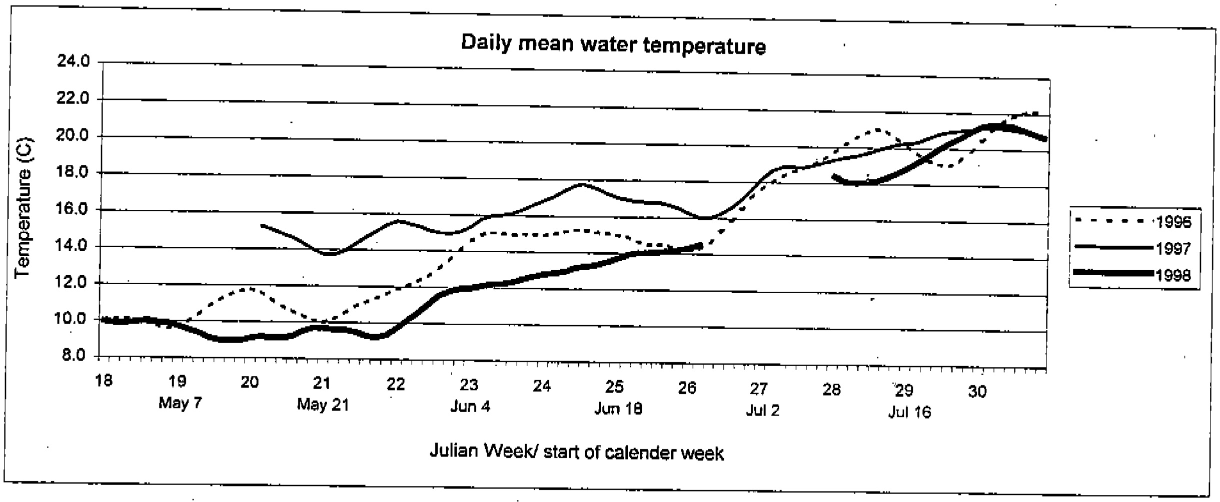

Figure 16. Daily mean water temperatures at Five Waters, 1996-1998.

While age 0 salmonid emigration occurred later in 1998, age 1 and age 2 steelhead emigration occurred latest in 1996 (Figure 15). The earliest emigration of age 1 and older steelhead occurred in 1997. High water temperatures early in 1997 may have triggered this earlier emigration (Figure 16). Steelhead abundance index totals for the three years 1996-1998 varied considerably (Table 8). The total steelhead abundance index for 1997 (50,840) was approximately 39 and 56 percent higher than those of 1996 and 1998, respectively.

Table 8. Steelhead abundance index totals by age class, New River rotary trap 1996-1998.

Year	Age 0	Age 1	Age 2	Age 3	Total
1996	5,768	16,125	8,774	95	30,762
1997	11,627	22,504	16,409	300	50,840
1998	5,155	10,439	6,702	70	22,366

In spite of high yearly variation in total steelhead abundance, year-to-year variation of age class proportions in 1996 to 1998 trap expansions was very small, and there were no discernable trends in year class strength. For instance, with the exceptionally high abundance of all steelhead age classes in 1997, one would expect to have observed disproportionately high abundance of age 1+ and older steelhead in 1998, but this was not the case. Instead, regardless of the strength of any particular year's total steelhead abundance index, age class proportions remained about the same (Figure 17).

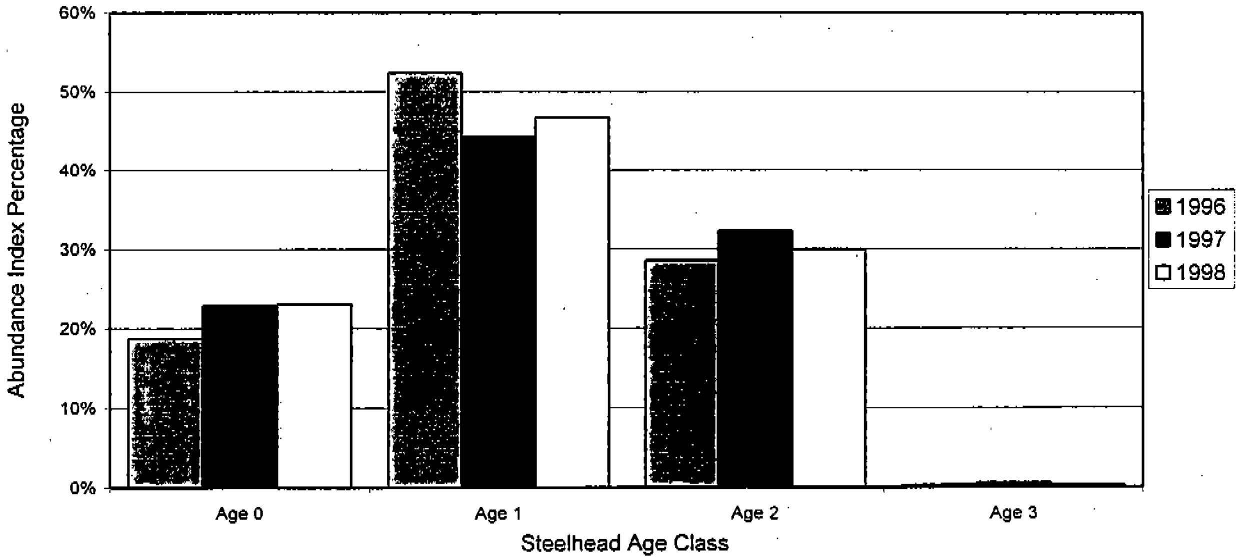

Figure 17. Relative steelhead age class proportions within respective abundance index totals, 1996-1998.

The 1997 steelhead abundance index total for the New River rotary trap was the highest for the ten years of monitoring. The highest abundance index totals prior to 1997 had occurred in 1990, 1991 1996, and 1992 respectively (Table 9).

Table 9. Steelhead abundance index totals for the years 1989-1998.

Fiscal Year	Steelhead Abundance Index Totals
1989	12,584
1990	33,884
1991	31,845
1992 *	**30,299**
1993	20,119
1994	19,725
1995	20,264
1996	30,762
1997	50,840
1998	22,366

* A rotary trap operated for only four nights from April 12-May 9, 1992, due a rain on snow storm event and subsequent loss of the trap.

Juvenile Over Summer Rearing

Juvenile Rainbow Trout/Steelhead

A comparison of juvenile salmonid index reach counts from 1990 through 1998, showed higher age 0 steelhead densities in the upper mainstem and tributary reaches than occurred in lower New River mainstem index reaches, and is likely associated with the proximity to spawning areas. This trend did not occur for age 1 and age 2 steelhead, whose densities, although lower than age 0 fish, did not differ appreciably between the lower and upper mainstem and tributary index reaches (Figure 18).

The pattern of higher age 0 steelhead densities in the upper mainstem and tributary index reaches was consistent through the years despite annual differences in total age 0 steelhead mean densities (Figure 19). Overall, age 2 steelhead densities were low (< 0.05 fish/m^2) and showed a trend similar to age 1 fish by index reach area (Figure 18) and by year (Figure 19).

Juvenile index counts, 1990 through 1995, were conducted following winter/spring periods of less than normal precipitation associated with seven years of drought (1989-1995). Juvenile index counts for 1996-1998 were conducted following winter/spring periods of normal to above-normal precipitation. The two years having highest total age 0 densities occurred in 1992 and 1994, during very low summer flows and relatively high July and August mean water temperatures. In general, the warmest water temperatures occurred during lowest flows. Exceptions to this occurred in 1991 and 1996, when water temperatures remained relatively high despite higher flow conditions (Figure 20).

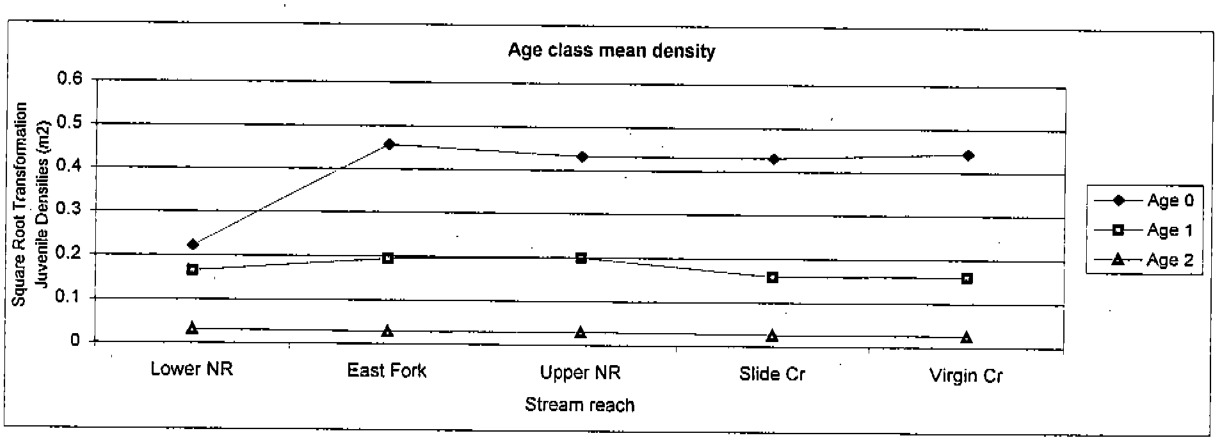

Figure 18. Mean steelhead rearing densities for age 0, age 1 and age 2 fish by stream reach.

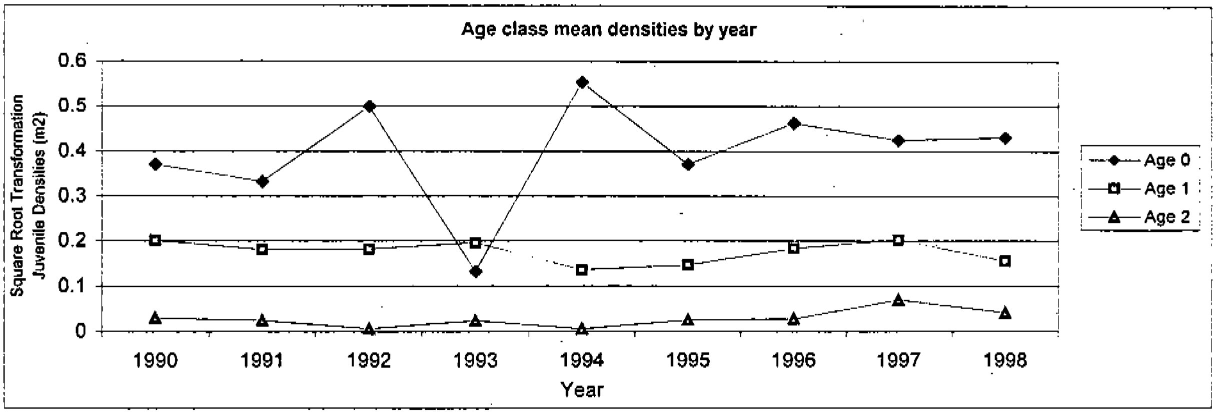

Figure 19. Mean steelhead rearing densities for age 0, age 1 and age 2 fish by year, 1990-1998.

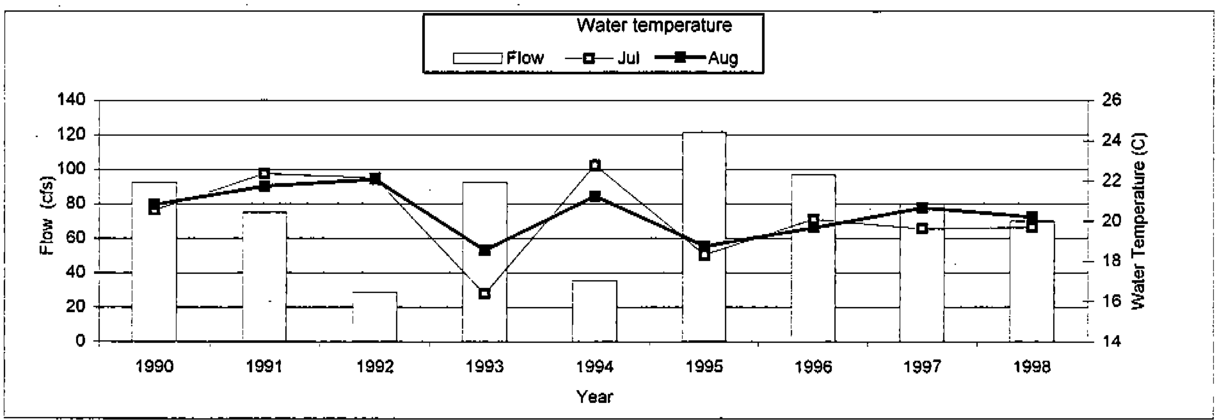

Figure 20. Mean Flow and water temperature at the Five Waters in July and August, 1990-1998

Regression analysis showed a moderately strong relationship between stream discharge and average water temperatures recorded at Five Waters. An R-square of 0.60 occurred in July (df=143), however a weak relationship occurred in August (R-square=0.26, df=49), and was likely due to fewer gage readings (Figure 21). This correlation was based on all days in July and August, from 1990 to 1998, where a gage reading and temperature data were recorded concurrently. Year to year variation in age 0 densities seemed to track well with July and August average water temperatures (Figure 20). Age 0 densities were lower with higher stream discharge and lower average water temperatures. Conversely, age 0 densities were higher during lower flows and warmer water temperatures.

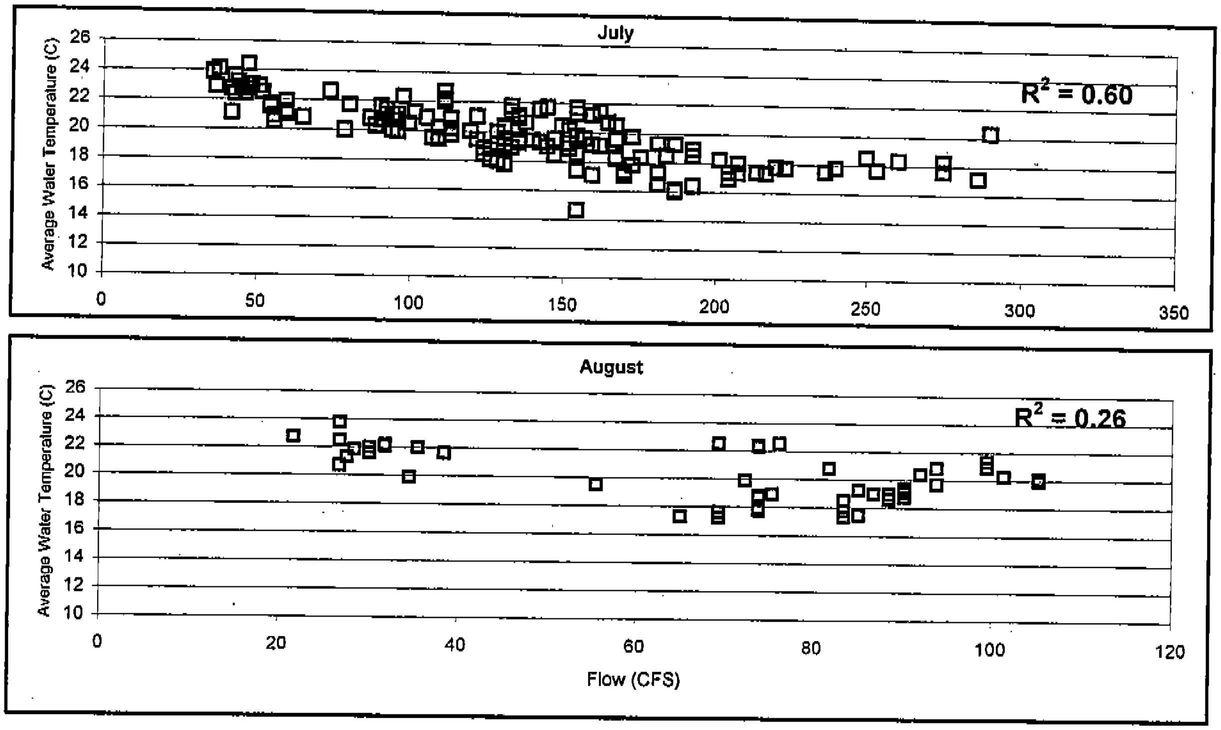

Figure 21. Relationship between gage discharge and water temperature at Five Waters in July and August, 1990-1998.

Besides stream discharge and associated water temperatures, factors such as the number of adults returning would also have an effect on rearing densities, with differences in year-class strength likely to be the most pronounced in age 0 fish in the upper index reaches. Age 1 and age 2 fish did not show marked changes in year to year rearing densities, which may be due to density dependent factors. As fish grow, habitat requirements change and new territories are sought and defended. Smaller less aggressive fish are thought to be displaced downstream to rear in the mainstem or in other tributaries prior to smolting and emigration to the estuary. From rotary trap catches, age 1 fish were the largest (non smolt) component of trap catches and may indicate saturation of rearing habitat utilized by age 1 fish. This theory that smaller, less aggressive fish are displaced downstream has recently come under question. It has been suggested that age 1 fish may posses a " pioneer" trait in which they actively seek new habitats, not necessarily having been displaced (Reeves, personal communication, 1999). If this is true, this " pioneer" trait adds some uncertainty to interpretation of emigration trends and/or rearing densities with regards to rearing conditions or habitat availability.

Drawing an inference between the number of returning adults and juvenile densities is difficult and stems in part from the fact that New River adult counts only represent summer steelhead. The only indication of year to year fall steelhead returns to the Trinity River are from CDFG counts at the Willow Creek Weir (WCW). In addition, there are no estimates of winter-run steelhead returns to the Trinity River. Assuming that fall-run steelhead entering New River were proportional to natural escapement estimates past the WCW, the relative magnitude was used as a surrogate estimate of New River fall-run steelhead returns (Figure 22). However, this did not show any clear relationship between adults and age 0 densities.

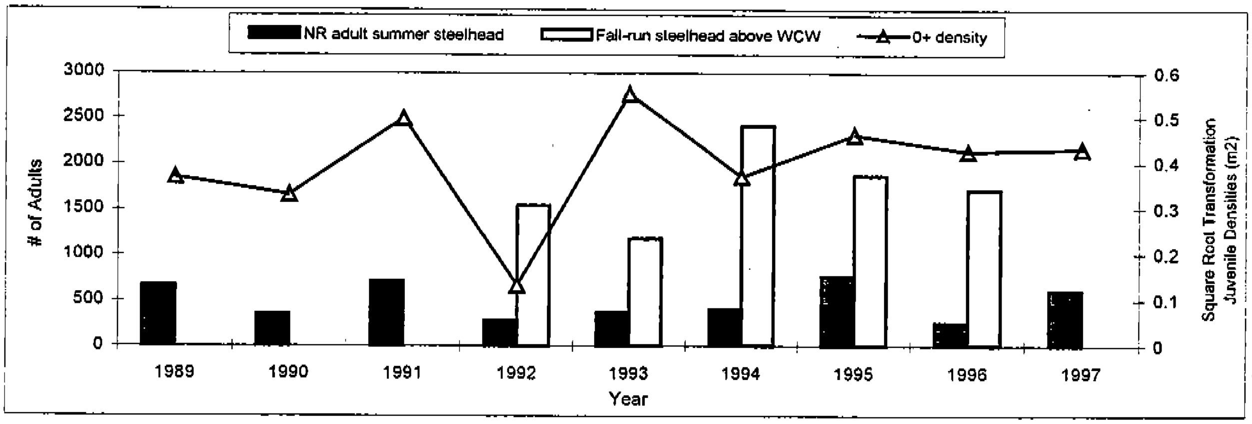

Figure 22. Estimated adult steelhead returns and age 0 steelhead densities in New River.

Because the counting of fish by visual observation can be highly variable between divers and between teams (Schill and Griffith 1984 cited *in* Cross 1989), and due to the fact that index reach counts were not subject to verification measures, i.e. electrofishing or diver calibration, this data should be viewed with caution.

Steelhead densities were compared between riffle, run and pool macrohabitat types. There was only a slight preference for pool habitat over run and riffle habitats. This was true across all age-classes for all years (Figure 23). In Big French Creek (the next major tributary to the Trinity River upstream of New River), the USFS found no consistent habitat preference by any steelhead age class throughout the Big French Creek drainage (Cross 1989).

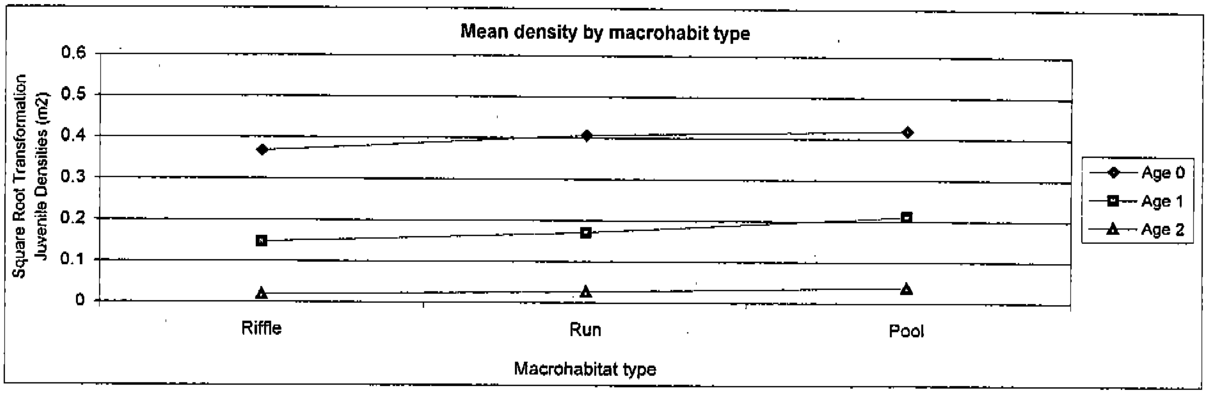

Figure 23. Mean juvenile steelhead densities for age 0, age 1 and age 2 fish by macrohabitat type, 1990-1998.

Recommended Future Monitoring

New River is predominately a steelhead stream with a relatively small run of spring and fall chinook salmon. It is recommended that monitoring of summer steelhead and spring chinook salmon in mid-summer continue. The same reaches should be surveyed each year. However, if time and personnel permit, it would be interesting to know more about reaches that have not been surveyed for summer steelhead. In particular, the area of Virgin Creek (upstream of Soldier Creek), the areas of Slide Creek (upstream of North Fork of Eagle Creek and Eagle Creek confluence) and Slide Creek upstream of the confluence with Eagle Creek. On the East Fork New River, the areas including the South Fork of the East Fork, Cabin Creek and the East Fork upstream of confluence of Cabin Creek.

Spring and fall chinook redd surveys should be continued. The best information on spring chinook comes from surveys conducted in early to late October. It gets more difficult to decipher spring from fall chinook redds when surveys are conducted only in November. In addition, the likelihood of higher flow and poor visibility increases by early to mid-November.

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APPENDICES

Appendix A. List of Julian Weeks and calendar dates.

Julian Week	Calendar Date		Julian Week	Calendar Date	
	Start	End		Start	End
1	Jan 01	Jan 07	27	Jul 02	Jul 08
2	Jan 08	Jan 14	28	Jul 09	Jul 15
3	Jan 15	Jan 21	29	Jul 16	Jul 22
4	Jan 22	Jan 28	30	Jul 23	Jul 29
5	Jan 29	Feb 04	31	Jul 30	Jul 05
6	Feb 05	Feb 11	32	Aug 06	Aug 12
7	Feb 12	Feb 18	33	Aug 13	Aug 19
8	Feb 19	Feb 25	34	Aug 20	Aug 26
9	Feb 26	Mar 04	35	Aug 27	Sept 02
10	Mar 05	Mar 11	36	Sept 03	Sept 09
11	Mar 12	Mar 18	37	Sept 10	Sept 16
12	Mar 19	Mar 25	38	Sept 17	Sept 23
13	Mar 26	Apr 01	39	Sept 24	Sept 30
14	Apr 02	Apr 08	40	Oct 01	Oct 07
15	Apr 09	Apr 15	41	Oct 08	Oct 14
16	Apr 16	Apr 22	42	Oct 15	Oct 21
17	Apr 23	Apr 29	43	Oct 22	Oct 28
18	Apr 30	May 06	44	Oct 29	Nov 04
19	May 07	May 13	45	Nov 05	Nov 11
20	May 14	May 20	46	Nov 12	Nov 18
21	May 21	May 27	47	Nov 19	Nov 25
22	May 28	Jun 03	48	Nov 26	Dec 02
23	Jun 04	Jun 10	49	Dec 03	Dec 09
24	Jun 11	Jun 17	50	Dec 10	Dec 16
25	Jun 18	Jun 24	51	Dec 17	Dec 23
26	Jun 25	Jul 01	52	Dec 24	Dec 31

Appendix B. Summary of Freese and Taylor (1979). Copied from New River Summary Report, Big Bar Ranger District, Shasta-Trinity National Forest. (T#) indicates a map reference.

September 3, 1979

T1- Slide Creek: Approximately 16 cfs at 59 degrees F at 1900. Rainbow trout-steelhead (RT-SH) 1½-28" , average approximately 3½" , approximately 90-100 per 100'. 17 adult summer steelhead (SSH) seen. Very important SSH and winter steelhead (WSH) habitat.

T1A- Eagle Creek: Approximately 10 cfs at 59 degrees F at 1730. RT-SH as above. Not surveyed beyond 100 yards above mouth. Local residents relate that adult SSH are present in stream. Very important SSH and WSH habitat.

T1B- Approximately 1.0 cfs at 56 degrees F at 1900. Not available to steelhead (NATSH). No fish seen.

September 4, 1979

T2- Virgin Creek: Approximately 12 cfs at 57 degrees at 1215. RT-SH approximately 1 1/2-30" , average approximately 3½" . Approximately 75 adult SSH seen. Very important SSH and WSH habitat.

T2A- Fourmile Creek: Approximately 0.3 cfs at 54 F at 1215. NASH. 15' vertical falls at mouth. No Fish seen.

T2B- Approximately 1.5 cfs at 54 degrees F at 1330. NATSH

T2C- Approximately 1.2 cfs at 57 degrees F at 1550. NATSH, possibly used by WSH. TR-SH 1½ -5" , average 2" , approximately 20 per 100" .

T3 Approximately 0.2 cfs at 55 degrees F at 1700. Steep and rocky. NATSH.

T4- Dry.

T5- Dry

T6- Barron Creek: Approximately 1.5 cfs at 55 degrees F at 1845. RT-SH 1½" long; 15-20 per 100'. NATSSH: possibly used by WSH.

T7- Dry.

T8- Dry

T9- Caraway Creek: Approximately 1.0 cfs at 53 degrees F at 1715. NATSH.

T10- East Fork, New River: Approximately 18 cfs at 63 degrees F at 1330. RT-SH approximately 1 ½-28" , average 4" . Four adult SH, important SSH and WSH habitat.

September 2, 1979

T10A-Cabin Creek: Approximately 3.0 cfs at 54 degrees F at 1030. RT-SH approximately 25/100', 1 ½-6" , average 2 ½. No adult SH seen. Probably important WSH habitat.

T10B-South Fork of East Fork: Approximately 6.5 cfs at 57 degrees F at 1220. RT-SH approximately 15/100', 1 ½-6" long, average 2 ½. No adult SH seen. Probably used by and important to WSH.

T10C-Semore Gulch: Approximately 1.5 cfs at 56 degrees F at 1430. NATSSH.

T10D-Pony Creek: Approximately 4.0 cfs at 58 degrees F at 1540. RT-SH approximately 15-20/100'. 1½-6" , average 2" long. No adult SH seen. Probably important to WSH.

T10E-White Creek: Approximately 1.0 cfs at 57 degrees F at 1715. NATSH.

T10G-Whiskey Creek: Approximately 0.1 cfs at 56 degrees F at 1650. NATSH.

September 3, 1979

T10H-Jim Jam Creek: Approximately 0.5 cfs at 56 degrees F at 1130. NATSH.

T10I-Approximately 0.1 cfs at 57 degrees F at 1130. NATSH.

T10J-Fall Creek: Less than 0.1 cfs at 57 degrees F at 1135. NATSH.

September 6, 1979

T11- Dry

T12- Devil's Canyon: Approximately 6.0 cfs at 60 degrees at 1500. RT-SH 1 ½ -6" , average 2 ½. Approximately 30-40 per 100'. No adult SSH observed. Probably important as winter SH habitat.

September 7, 1979

T13- Approximately 0.3 cfs at 52 degrees F at 1100. NATSH.

T14- Mills Creek: Approximately 0.3 cfs at 58 degrees F at 1230. NATSH.

T15- Fall Creek: Approximately 0.2 cfs at 61 degrees F at 1245. NATSH.

T16- Quinby Creek: Approximately 3.0 cfs at 59 degrees F at 1430. 10' BR falls 100' above mouth. NATSH.

T17- Dry. NATSH.
T18- Sqauw Creek: Approximately 0.2 cfs at 1555. NATSH.

T19- Dry. NATSH.
T20- Approximately 0.2 cfs at 59 degrees F at 1630. NATSH.

September 8, 1979

T21- Approximately 0.1 cfs at 56 degrees F at 1215. NATSH.

T22- Dry. NATSH.

T23- Panther Creek: Approximately 7.0 cfs at 59 degrees F at 1645. Mouth is 50' BR fall. NATSH.

T24- China Creek: Approximately 2.5 cfs at 58 degrees F at 1715. 9' vertical fall over BR approximately 75' above mouth. NATSH.

September 9, 1979

T25- Dry.

T26- Big Creek: Approximately 2.5 cfs at 54 degrees F at 1100. RT-SH 2-2 ½" , 10-15/100'. No SSH observed. Probably important to WSH.

T27- Bell Creek: Approximately 0.4 cfs at 59 degrees F 1300. RT-SH 10-15/100'. NATSSH. Probably used by WSH.

T28- Approximately 1.2 cfs at 58 degrees F at 1315. NATSH.

T29- Approximately 0.2 cfs at 59 degrees F at 1325. NATSH.

T30- Dyer Creek: Approximately 0.1 cfs at 60 degrees F at 1350. NATSH.

T31- Approximately 0.7 cfs at 64 degrees F at 1515. Enters over 25' BR fall. NATSH.

T32- Dry. NATSH.

Appendix C. Daily discharge (cfs) at the Five Waters stream gage (rkm 3.4) April through July, 1996-1998.

Date	1996	1997	1998
1-Apr	1,326		
2-Apr	1,243	457	
3-Apr	1,125	451	
4-Apr	1,032	436	
5-Apr	962	416	
6-Apr	945	392	
7-Apr	988	388	
8-Apr	1,050	369	1,041
9-Apr	1,059	365	1,032
10-Apr	979	360	1,032
11-Apr	878	347	
12-Apr	815	339	
13-Apr	741	339	919
14-Apr	692	334	854
15-Apr	671	326	808
16-Apr	846	326	1,041
17-Apr	792	322	763
18-Apr	770	322	755
19-Apr	770	698	763
20-Apr	815		839
21-Apr	831		854
22-Apr	903		1,014
23-Apr	945	1,436	1,223
24-Apr	4,213	1,183	1,203
25-Apr	2,376	1,014	1,059
26-Apr		886	953
27-Apr		815	988
28-Apr	1,243	734	1,125
29-Apr	1,106	705	1,274
30-Apr	1,068	698	1,369
Min=	671	322	755
Max=	4,213	1,436	1,369
Mean=	1,114	556	996
Median=	953	404	1,014
Average=	1,114	556	996
n=	28	26	21

Date	1996	1997	1998
1-May	1,032	678	1,425
2-May	996	625	1,470
3-May	854	619	1,223
4-May	785	581	1,068
5-May	785	528	1,014
6-May	685	511	953
7-May	645	489	970
8-May	581	467	1,078
9-May	581	462	988
10-May	551	457	846
11-May	539	451	755
12-May	581	416	734
13-May	593	402	692
14-May	763	388	632
15-May	632	369	632
16-May	606	356	625
17-May	692	347	612
18-May	839	326	569
19-May	996	322	581
20-May	808	294	581
21-May	1,447	286	551
22-May	1,493	275	534
23-May	1,183	286	539
24-May	945	286	563
25-May	839	279	734
26-May	785	257	651
27-May	712	286	612
28-May	651	253	632
29-May	581	282	970
30-May	557	250	823
31-May	522	246	770
Min=	522	246	534
Max=	1,493	678	1,470
Mean=	783	389	801
Median=	712	356	734
Average=	783	389	801
n=	31	31	31

Date	1996	1997	1998
1-Jun	500	246	785
2-Jun	489	229	903
3-Jun	478	233	854
4-Jun	472	451	792
5-Jun	436	294	800
6-Jun	416	275	823
7-Jun	402	267	854
8-Jun	374	260	777
9-Jun	347	233	748
10-Jun	330	236	763
11-Jun	326	229	727
12-Jun	322	217	698
13-Jun	298	217	734
14-Jun	286	207	712
15-Jun	282	201	678
16-Jun	279	195	658
17-Jun	264	184	575
18-Jun	250	184	563
19-Jun	243	181	528
20-Jun	236	167	505
21-Jun	233	167	505
22-Jun	226	162	494
23-Jun	217	159	462
24-Jun	226	157	446
25-Jun	226	159	416
26-Jun	226	154	374
27-Jun	223	152	369
28-Jun	213	149	369
29-Jun	204	152	374
30-Jun	186	154	360
Min=	186	149	360
Max=	500	451	903
Mean=	307	209	622
Median=	280	198	668
Average=	307	209	622
n=	30	30	30

Date	1996	1997	1998
1-Jul	184	154	356
2-Jul	184		334
3-Jul	175	154	334
4-Jul	173	147	318
5-Jul	167	144	314
6-Jul	162	154	294
7-Jul	157	133	290
8-Jul	154	130	275
9-Jul	152	128	260
10-Jul	149	126	250
11-Jul	137	124	239
12-Jul	135	124	223
13-Jul	133		220
14-Jul	154		207
15-Jul	133	113	201
16-Jul	135	94	192
17-Jul	128	109	192
18-Jul	130	109	186
19-Jul	126	109	181
20-Jul		105	173
21-Jul		101	167
22-Jul	113	99	165
23-Jul		96	159
24-Jul		96	154
25-Jul		94	162
26-Jul		92	154
27-Jul		92	144
28-Jul		90	142
29-Jul	98		135
30-Jul			130
31-Jul		87	
Min=	98	87	130
Max=	184	154	356
Mean=	147	116	218
Median=	149	109	197
Average=	147	116	218
n=	21	26	30

Appendix D. New River steelhead and salmon catch totals, abundance index totals and cumulative abundance index percentages, Fiscal Year 1996.

Week of	Julian Week	Mean River Flow (cfs)	Trap Days	Steelhead Catch Totals YOY	1+	2+	3+	Catch Total	Steelhead Index Totals Expanded for 7 days trapping YOY	1+	2+	3+	Index Total	Smolt*	Cumulative Index (%) YOY	1+	2+	3+	Smolt
12-Mar	11		0																
19-Mar	12		0																
26-Mar	13	1,154	6	0	28	22	2	52	0	482	431	37	950	505	0.0%	3.0%	4.9%	38.9%	6.6%
2-Apr	14	1,032	7	3	63	34	1	101	43	861	463	14	1,381	534	0.7%	8.3%	10.2%	53.7%	13.5%
9-Apr	15	834	7	1	130	88	5	224	9	1,297	873	44	2,223	789	0.9%	16.4%	20.1%	100.0%	23.8%
16-Apr	16	822	5	2	24	43	0	69	40	410	775	0	1,225	690	1.6%	18.9%	29.0%		32.8%
23-Apr	17	945	1	0	6	20	0	26	24	899	1,149	0	2,072	1,138	2.0%	24.5%	42.1%		47.6%
30-Apr	18	887	7	1	73	43	0	117	14	1,004	597	0	1,615	569	2.3%	30.7%	48.9%		55.0%
7-May	19	582	7	3	321	184	0	508	24	2,750	1,597	0	4,371	1,051	2.7%	47.8%	67.1%		68.7%
14-May	20	762	7	2	226	175	0	403	23	2,595	1,990	0	4,608	1,486	3.1%	63.9%	89.8%		88.0%
21-May	21	1,058	7	32	72	30	0	134	368	853	368	0	1,589	462	9.4%	69.2%	93.9%		94.0%
28-May	22	540	7	29	191	46	0	266	199	1,409	351	0	1,959	341	12.9%	77.9%	97.9%		98.5%
4-Jun	23	397	7	101	303	21	0	425	509	1,536	114	0	2,159	104	21.7%	87.4%	99.2%		99.8%
11-Jun	24	294	7	114	181	2	0	297	520	809	9	0	1,338	4	30.7%	92.4%	99.4%		99.9%
18-Jun	25	233	7	241	156	5	0	402	800	504	17	0	1,321	7	44.6%	95.6%	99.5%		100.0%
25-Jun	26	209	7	200	118	3	0	321	633	384	8	0	1,025	0	55.6%	97.9%	99.6%		
2-Jul	27	167	7	364	83	9	0	456	912	207	21	0	1,140	2	71.4%	99.2%	99.9%		
9-Jul	28	142	7	359	39	4	0	402	950	103	11	0	1,064	0	87.9%	99.9%	100.0%		
16-Jul	29	129	4	162	7	0	0	169	700	22	0	0	722	0	100.0%	100.0%			
23-Jul	30		0																
30-Jul	31		0																
6-Aug	32		0																
13-Aug	33		0																
			107	1,614	2,021	729	8	4,372	5,768	16,125	8,774	95	30,762	7,682					

* Included as an indicator of the number of age 1-3 steelhead emigrating as smolts. Note: The pre-smolt category was not recorded in 1996.

Week of	Julian Week	Mean River Flow (cfs)	Trap Days	Catch Totals Chinook YOY	Chinook 1+	Coho YOY	Coho 1+	Index Totals Expanded for 7 days trapping Chinook YOY	Chinook 1+	Coho YOY	Coho 1+	Cumulative Index (%) Chinook YOY	Chinook 1+	Coho YOY	Coho 1+
12-Mar	11		0												
19-Mar	12		0												
26-Mar	13	1,154	6	0	0	0	0	0	0	0	0				
2-Apr	14	1,032	7	0	0	0	0	0	0	0	0	0.0%			
9-Apr	15	834	7	1	0	0	0	13	0	0	0	2.4%			
16-Apr	16	822	5	1	0	0	0	19	0	0	0	5.8%			
23-Apr	17	945	1	0	0	0	0	42	0	0	0	13.4%			
30-Apr	18	887	7	5	0	0	0	66	0	0	0	25.3%		0.0%	
7-May	19	582	7	2	0	1	0	16	0	13	0	28.2%		21.7%	
14-May	20	762	7	5	0	2	0	55	0	28	0	38.2%		68.3%	
21-May	21	1,058	7	5	0	0	0	63	0	0	0	49.5%		68.3%	
28-May	22	540	7	5	0	0	0	37	0	0	0	56.2%		68.3%	
4-Jun	23	397	7	25	0	0	0	127	0	0	0	79.2%		68.3%	
11-Jun	24	294	7	11	0	0	0	49	0	0	0	88.1%		68.3%	
18-Jun	25	233	7	12	0	1	0	37	0	3	0	94.8%		73.3%	
25-Jun	26	209	7	4	0	1	0	13	0	3	0	97.1%		78.3%	
2-Jul	27	167	7	6	0	0	0	16	0	0	0	100.0%		78.3%	0.0%
9-Jul	28	142	7	0	0	2	2	0	0	6	5			88.3%	100.0%
16-Jul	29	129	4	0	0	2	0	0	0	7	0			100.0%	
23-Jul	30		0												
30-Jul	31		0												
6-Aug	32		0												
13-Aug	33		0												
			107	82	0	9	2	553	0	60	5				

Appendix E. New River weekly fork length data for steelhead, coho and chinook, 1996.

		STEELHEAD AGE 0 Fork Length (mm)					STEELHEAD AGE 1 Fork Length (mm)					STEELHEAD AGE 2 Fork Length (mm)					STEELHEAD AGE 3 Fork Length (mm)					COHO AGE 0 & AGE 1 Fork Length (mm)					CHINOOK AGE 0 Fork Length (mm)				
Julian Week	Calendar week	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd
12	3/19 - 03/25/96																														
13	3/26 - 04/01/96						28	95.2	76	158	20.65	21	167.8	124	212	22.41	2	204.5	181	228	33.23										
14	4/2 - 04/08/96	3	26.7	26	27	0.58	61	97.4	73	150	19.38	33	166.4	125	210	19.69	1	185.0	185	185											
15	4/9 - 04/15/96	1	30.0	30	30		111	89.6	70	147	12.23	73	158.9	120	212	19.82	4	201.0	191	213	9.93						1	57.0	57	57	
16	4/16 - 04/22/96						24	91.0	69	134	12.82	42	164.9	124	202	19.68											1	63.0	63	63	
17	4/23 - 04/29/96						6	107.5	85	137	23.22	20	169.8	135	207	18.41															
18	4/30 - 05/06/96	1	26.0	26	26		73	91.4	68	131	10.76	43	164.7	134	195	14.88											3	60.0	55	65	5.00
19	5/7 - 05/13/96						179	92.4	63	160	12.97	112	169.7	145	212	13.80						1	43.0	43	43		1	61.0	61	61	
20	5/14 - 05/20/96	2	28.0	27	29	1.41	144	94.0	69	147	11.81	100	164.4	139	198	12.48						2	52.0	51	53	1.41	5	64.0	61	68	2.74
21	5/21 - 05/27/96	22	31.8	27	46	5.85	47	98.6	77	155	14.27	22	166.5	144	192	14.94											3	70.0	67	73	3.00
22	5/28 - 06/03/96	28	38.3	21	48	7.35	185	99.7	69	124	11.39	45	164.1	120	220	15.16											4	81.0	77	86	4.11
23	6/4 - 06/10/96	63	44.7	30	79	8.21	210	98.2	77	148	11.52	16	155.0	129	184	14.83											23	78.0	46	89	9.32
24	6/11 - 06/17/96	98	43.0	25	57	6.43	161	98.8	75	133	10.98	2	153.5	152	155	2.12											11	84.0	44	93	14.00
25	6/18 - 06/24/96	189	48.1	26	80	6.30	132	102.4	77	140	11.04	5	137.4	121	165	17.59						1	58.0	58	58		12	83.0	37	101	15.34
26	6/25 - 07/01/96	142	46.5	30	75	6.00	93	105.1	76	154	13.06	3	123.3	122	124	1.15						1	70.0	70	70		4	84.0	80	89	3.87
27	7/2 - 07/08/96	172	49.3	38	70	5.14	46	108.0	66	142	15.18	4	153.8	124	172	20.69											6	94.0	90	98	2.67
28	7/9 - 07/15/96	198	51.9	38	72	6.35	23	111.0	88	135	11.33	2	136.5	135	138	2.12						4	74.5	64	82	8.22					
29	7/16 - 07/22/96	114	53.0	39	72	6.15	6	110.2	100	127	10.28											2	76.5	74	79	3.53					
30	7/23 - 07/29/96																														
31	7/30 - 08/05/96																														

Appendix F. New River steelhead and salmon catch totals, abundance index totals and cumulative abundance index percentages, Fiscal Year 1997.

Week of	Julian Week	Mean River Flow (cfs)	Trap Days	Steelhead Catch Totals YOY	1+	2+	3+	Catch Total	Steelhead Index Totals Expanded for 7 days trapping YOY	1+	2+	3+	Index Total	Smolt *	Cumulative Index (%) YOY	1+	2+	3+	% Smolt
12-Mar	11		0																
19-Mar	12		0																
26-Mar	13		0																
2-Apr	14	416	7	0	46	93	8	147	0	356	663	51	1,070	495		1.6%	4.0%	17.0%	8.9%
9-Apr	15	344	7	0	348	367	1	716	0	1,868	1,976	5	3,849	1,272		9.9%	16.1%	18.7%	31.6%
16-Apr	16	417	4	0	414	548	10	972	72	4,927	7,365	167	12,531	1,098	0.6%	31.8%	61.0%	74.3%	51.2%
23-Apr	17	831	4	5	73	31	0	109	167	2,735	3,244	72	6,218	699	2.1%	43.9%	80.7%	98.3%	63.7%
30-Apr	18	606	7	5	214	159	0	378	47	1,886	1,450	0	3,383	1,125	2.5%	52.3%	89.6%	98.3%	83.9%
7-May	19	449	7	33	482	140	0	655	238	3,551	1,057	0	4,846	488	4.5%	68.1%	96.0%	98.3%	92.6%
14-May	20	343	6	15	460	70	0	545	108	3,148	446	0	3,702	198	5.4%	82.1%	98.7%	98.3%	96.1%
21-May	21	279	7	61	205	19	0	285	273	925	86	0	1,284	176	7.8%	86.2%	99.3%	98.3%	99.3%
28-May	22	249	6	206	237	6	1	450	946	1,090	29	5	2,070	20	15.9%	91.0%	99.4%	100.0%	99.6%
4-Jun	23	288	6	250	170	0	0	420	1,342	1,008	2	0	2,352	1	27.5%	95.5%	99.4%		99.7%
11-Jun	24	207	7	272	93	14	0	379	893	310	47	0	1,250	11	35.1%	96.9%	99.7%		99.9%
18-Jun	25	168	7	252	44	3	0	299	797	143	9	0	949	3	42.0%	97.5%	99.8%		99.9%
25-Jun	26	154	7	693	119	11	0	823	2,070	359	32	0	2,461	0	59.8%	99.1%	100.0%		99.9%
2-Jul	27	144	6	476	21	0	0	497	1,836	114	3	0	1,953	0	75.6%	99.6%			99.9%
9-Jul	28	123	5	387	9	0	0	396	1,820	38	0	0	1,858	0	91.2%	99.8%			99.9%
16-Jul	29	104	7	103	8	0	0	111	477	37	0	0	514	5	95.3%	100.0%			100.0%
23-Jul	30	93	6	87	1	0	0	88	541	9	0	0	550	0	100.0%				100.0%
30-Jul	31		0																
6-Aug	32		0																
13-Aug	33		0																
			106	2,845	2,944	1,461	20	7,270	11,627	22,504	16,409	300	50,840	5,591					

* Included as an indicator of the number of age 1-3 steelhead emigrating as smolts. Note: The pre-smolt category was not recorded in 1997.

Week of	Julian Week	Mean River Flow (cfs)	Trap Days	Catch Totals Chinook YOY	Chinook 1+	Coho YOY	Coho 1+	Index Totals Expanded for 7 days trapping Chinook YOY	Chinook 1+	Coho YOY	Coho 1+	Cumulative Index (%) Chinook YOY	Chinook 1+	Coho YOY	Coho 1+
12-Mar	11		0												
19-Mar	12		0												
26-Mar	13		0												
2-Apr	14	416	7	0	0	0	0	0	0	0	0	0.0%			
9-Apr	15	344	7	5	0	0	0	28	0	0	0	1.4%		0.0%	
16-Apr	16	417	4	1	0	1	0	36	0	20	0	3.2%		16.9%	
23-Apr	17	831	4	9	0	1	0	125	0	34	0	9.6%		45.8%	
30-Apr	18	606	7	32	0	4	0	282	0	45	0	23.9%		83.9%	
7-May	19	449	7	54	0	2	0	390	0	14	0	43.6%		95.8%	
14-May	20	343	6	53	0	0	0	377	0	0	0	62.7%		95.8%	
21-May	21	279	7	54	0	0	0	242	0	0	0	75.0%		95.8%	
28-May	22	249	6	32	0	1	0	144	0	5	0	82.3%		100.0%	
4-Jun	23	288	6	42	0	0	0	215	0	0	0	93.2%			
11-Jun	24	207	7	26	0	0	0	81	0	0	0	97.3%			
18-Jun	25	168	7	14	0	0	0	45	0	0	0	99.5%			
25-Jun	26	154	7	3	0	0	0	9	0	0	0	100.0%			
2-Jul	27	144	6	0	0	0	0	0	0	0	0				
9-Jul	28	123	5	0	0	0	0	0	0	0	0				
16-Jul	29	104	7	0	0	0	0	0	0	0	0				
23-Jul	30	93	6	0	0	0	0	0	0	0	0				
30-Jul	31		0												
6-Aug	32		0												
13-Aug	33		0												
			106	325	0	9	0	1,974	0	118	0				

Appendix G. New River weekly fork length data for steelhead, coho and chinook, 1997.

Julian		STEELHEAD AGE 0 Fork Length (mm)					STEELHEAD AGE 1 Fork Length (mm)					STEELHEAD AGE 2 Fork Length (mm)					STEELHEAD AGE 3 Fork Length (mm)					COHO AGE 0 & AGE 1 Fork Length (mm)					CHINOOK AGE 0 Fork Length (mm)				
Week	Calendar week	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd
12	3/19 - 03/25/97																														
13	3/26 - 04/01/97																														
14	4/2 - 04/08/97						37	82.5	65	108	11.58	61	164.2	126	198	19.18	4	215.3	210	223	6.40										
15	4/9 - 04/15/97						192	86.4	65	119	11.19	204	165.0	123	214	17.83	1	236.0	236	236							2	43.0	41	45	2.93
16	4/16 - 04/22/97						109	86.9	55	120	12.10	110	168.8	133	211	20.69	1	235.0	235	235							1	43.0	43	43	
17	4/23 - 04/29/97	5	27.8	25	30	1.79	71	84.3	65	110	9.79	29	164.7	138	190	15.00						1	51.0	51	51		9	53.0	49	58	3.05
18	4/30 - 05/06/97	4	26.8	24	30	2.50	149	84.2	65	118	9.89	111	163.3	136	200	14.09						4	54.0	50	57	3.56	31	57.0	45	64	4.39
19	5/7 - 05/13/97	15	32.3	23	59	11.71	207	85.1	63	120	10.20	60	162.4	140	190	11.26						2	67.0	64	69	3.54	52	59.0	44	72	5.68
20	5/14 - 05/20/97	7	28.6	25	34	2.88	179	88.1	65	113	9.99	24	163.0	140	190	12.39											44	64.0	52	75	4.78
21	5/21 - 05/27/97	54	40.5	25	54	6.73	183	89.7	60	126	11.01	17	167.7	135	180	13.08											54	66.0	32	83	7.84
22	5/28 - 06/03/97	151	42.1	25	57	6.93	178	88.3	65	126	11.84	4	157.8	140	184	18.66	1	248.0	248	248		1	58.0	58	58		32	74.0	51	84	7.14
23	6/4 - 06/10/97	156	44.1	28	60	6.66	91	90.7	63	133	11.70																37	78.0	63	89	6.78
24	6/11 - 06/17/97	189	47.1	33	66	6.43	71	91.5	74	108	8.77	8	133.8	120	158	11.99											25	84.0	73	96	5.43
25	6/18 - 06/24/97	160	50.3	31	72	6.40	33	95.2	80	110	9.05	2	146.5	131	162	21.92											13	81.0	63	89	7.90
26	6/25 - 07/01/97	184	51.8	35	68	6.62	32	100.7	81	122	10.81	3	144.0	135	161	14.73											3	80.0	69	94	12.90
27	7/2 - 07/08/97	194	55.0	33	77	7.17	9	98.6	90	110	7.18																				
28	7/9 - 07/15/97	166	59.1	40	81	7.43	3	115.0	109	121	6.00																				
29	7/16 - 07/22/97	86	62.5	45	80	7.67	7	118.9	99	140	13.48																				
30	7/23 - 07/29/97						1	141.0	141	141																					
31	7/30 - 08/05/97																														

Appendix H. New River steelhead and salmon catch totals, abundance index totals and cumulative abundance index percentages, Fiscal Year 1998.

Week of	Julian Week	Mean River Flow (cfs)	Trap Days	Steelhead Catch Totals YOY	1+	2+	3+	Catch Total	Steelhead Index Totals Expanded for 7 days trapping YOY	1+	2+	3+	Index Total	Pre-Smolt *	Smolt *	Cumulative Index (%) YOY	1+	2+	3+	Pre-Smolt	Smolt
12-Mar	11		0																		
19-Mar	12		0																		
26-Mar	13		0																		
2-Apr	14		0																		
9-Apr	15	931	4	0	27	59	2	88	0	533	1,174	36	1,743	NA	NA	0.0%	5.1%	17.5%	51.4%		
16-Apr	16	862	6	2	314	174	2	492	25	4,096	2,269	20	6,410	NA	NA	0.5%	44.3%	51.4%	80.0%		
23-Apr	17	1,118	7	0	141	94	1	236	0	1,625	1,093	12	2,730	NA	NA	0.5%	59.9%	67.7%	97.1%		
30-Apr	18	1,217	7	0	34	38	0	72	0	419	490	0	909	NA	NA	0.5%	63.9%	75.0%	97.1%		
7-May	19	866	6	0	40	65	0	105	0	467	751	0	1,218	NA	NA	0.5%	68.4%	86.2%	97.1%		
14-May	20	605	7	1	87	73	0	161	8	684	575	0	1,267	112	405	0.6%	74.9%	94.8%	97.1%	22.1%	58.6%
21-May	21	598	7	3	126	34	0	163	18	756	220	0	994	103	186	1.0%	82.2%	98.1%	97.1%	42.4%	85.5%
28-May	22	820	7	4	67	8	0	79	28	478	49	0	555	46	43	1.5%	86.8%	98.8%	97.1%	51.5%	91.8%
4-Jun	23	794	7	4	39	5	0	48	25	266	33	0	324	22	33	2.0%	89.3%	99.3%	97.1%	55.8%	96.5%
11-Jun	24	683	7	30	25	1	0	56	178	149	6	0	333	42	6	5.5%	90.7%	99.4%	97.1%	64.1%	97.4%
18-Jun	25	500	7	104	104	5	0	213	476	477	24	0	977	99	5	14.7%	95.3%	99.7%	97.1%	83.6%	98.1%
25-Jun	26	374	7	157	67	2	0	226	613	261	8	0	882	46	0	26.6%	97.8%	99.9%	97.1%	92.7%	98.1%
2-Jul	27	308	7	162	28	0	0	190	554	92	0	0	646	13	0	37.3%	98.7%	99.9%	97.1%	95.3%	98.1%
9-Jul	28	229	7	209	23	1	1	234	497	56	2	2	557	10	13	47.0%	99.2%	99.9%	100.0%	97.2%	100.0%
16-Jul	29	179	7	303	12	1	0	316	763	30	3	0	796	9	0	61.8%	99.5%	99.9%		99.0%	
23-Jul	30	150	7	185	3	1	0	189	864	16	5	0	885	5	0	78.5%	99.7%	100.0%		100.0%	
30-Jul	31	129	2	67	2	0	0	69	1,106	34	0	0	1,140	0	0	100.0%	100.0%				
6-Aug	32		0																		
13-Aug	33		0																		
			109	1,231	1,139	561	6	2,937	5,155	10,439	6,702	70	22,366	507	691						

* Included as an indicator of the number of age 1-3 steelhead emigrating as pre-smolt or smolt. "NA" = Not recorded for this period.

Week of	Julian Week	Mean River Flow (cfs)	Trap Days	Catch Totals Chinook YOY	Chinook 1+	Coho YOY	Coho 1+	Index Totals Expanded for 7 days trapping Chinook YOY	Chinook 1+	Coho YOY	Coho 1+	Cumulative Index (%) Chinook YOY	Chinook 1+	Coho YOY	Coho 1+
12-Mar	11		0												
19-Mar	12		0												
26-Mar	13		0												
2-Apr	14		0												
9-Apr	15	931	4	0	0	0	0	0	0	0	0	0.0%			
16-Apr	16	862	6	0	0	0	0	0	0	0	0	0.0%			
23-Apr	17	1,118	7	3	0	0	0	33	0	0	0	2.2%			
30-Apr	18	1,217	7	1	0	0	0	13	0	0	0	3.0%			
7-May	19	866	6	7	0	0	0	77	0	0	0	8.1%			
14-May	20	605	7	14	0	0	0	108	0	0	0	15.2%			
21-May	21	598	7	25	0	0	0	159	0	0	0	25.7%			
28-May	22	820	7	16	0	0	0	104	0	0	0	32.5%			
4-Jun	23	794	7	7	0	0	0	50	0	0	0	35.8%			
11-Jun	24	683	7	25	0	0	0	150	0	0	0	45.7%			
18-Jun	25	500	7	36	0	0	0	170	0	0	0	56.8%			
25-Jun	26	374	7	87	0	0	0	339	0	0	0	79.1%			
2-Jul	27	308	7	48	0	0	0	160	0	0	0	89.7%			
9-Jul	28	229	7	54	0	0	0	131	0	0	0	98.3%			
16-Jul	29	179	7	10	0	0	0	26	0	0	0	100.0%			
23-Jul	30	150	7	0	0	0	0	0	0	0	0				
30-Jul	31	129	2	0	0	0	0	0	0	0	0				
6-Aug	32		0												
13-Aug	33		0												
			109	333	0	0	0	1,520	0	0	0				

Appendix I. New River weekly fork length data for steelhead, coho and chinook, 1998.

		STEELHEAD AGE 0 Fork Length (mm)					STEELHEAD AGE 1 Fork Length (mm)					STEELHEAD AGE 2 Fork Length (mm)					STEELHEAD AGE 3 Fork Length (mm)					COHO AGE 0 & AGE 1 Fork Length (mm)					CHINOOK AGE 0 Fork Length (mm)				
Julian Week	Calendar week	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd
12	3/19 - 03/25/98																														
13	3/26 - 04/01/98																														
14	4/2 - 04/08/98																														
15	4/9 - 04/15/98						27	98.8	67	188	27.49	59	184.4	142	247	23.47	2	226.5	184	259	45.96										
16	4/16 - 04/22/98	1	25	25	25		195	90.7	68	151	13.00	111	171.2	133	239	19.29	2	240.5	232	249	12.02										
17	4/23 - 04/29/98						135	92.3	65	140	12.26	90	171.0	124	227	18.60	1	212.0	212	212							3	58.7	56	63	3.79
18	4/30 - 05/06/98						33	90.4	77	128	9.83	38	165.4	132	205	18.70											1	48.0	48	48	
19	5/7 - 05/13/98						40	92.3	70	123	12.11	65	167.8	125	196	15.78											7	59.9	53	67	4.38
20	5/14 - 05/20/98	1	27	27	27		87	87.1	65	117	10.21	73	167.1	140	212	16.43											13	56.3	50	67	5.07
21	5/21 - 05/27/98	3	35.33	28	40	6.43	117	91.5	70	131	12.75	33	167.7	140	193	13.73											26	60.3	48	76	7.03
22	5/28 - 06/03/98	4	31	25	44	8.76	67	89.2	69	117	10.56	8	160.1	139	178	11.78											16	62.6	55	78	6.68
23	6/4 - 06/10/98	4	30.75	26	36	5.50	39	89.1	68	118	12.22	5	162.8	147	180	13.41											7	69.7	64	78	4.72
24	6/11 - 06/17/98	30	39.27	22	53	9.57	25	90.8	75	121	10.75	1	170.0	170	170												25	73.9	63	84	5.53
25	6/18 - 06/24/98	104	43.82	29	58	6.93	104	94.9	63	133	12.81	5	140.8	126	175	20.34											35	76.2	60	90	7.66
26	6/25 - 07/01/98	157	47.86	24	77	6.89	67	94.5	63	125	13.55	2	148.5	110	187	54.45											87	81.4	63	96	6.54
27	7/2 - 07/08/98	162	50.27	28	75	7.49	28	100.3	80	121	12.03																48	84.8	65	96	7.77
28	7/9 - 07/15/98	209	52.52	34	75	6.89	23	109.4	85	146	15.93	1	188.0	188	188		1	300.0	300	300							54	86.6	70	104	6.94
29	7/16 - 07/22/98	303	52.28	36	75	7.28	12	103.5	86	125	10.82	1	138.0	138	138												10	86.2	80	94	4.32
30	7/23 - 07/29/98	185	54.17	38	79	8.19	3	128.3	117	148	17.10	1	227.0	227	227																
31	7/30 - 08/05/98	67	57.84	43	84	8.43	2	124.0	109	139	21.21																				